TECHNOLOGY DEPT.

ELECTRICAL REVIEW

FOUNDED 1872

Vol. CXXXI. No. 3380. SEPTEMBER 4, 1942 6d. WEEKLY

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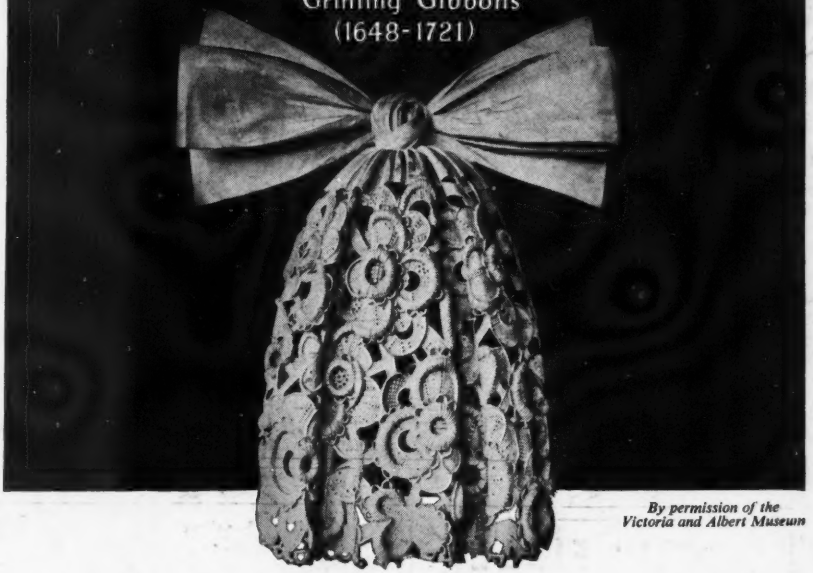
MEMORIES OF THE GREAT CRAFTSMEN

Grinling Gibbons
(1648-1721)



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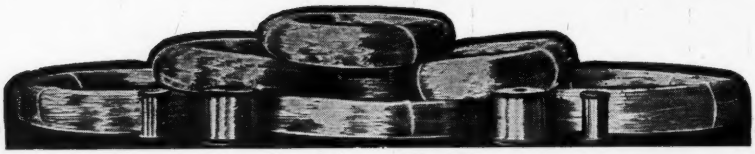

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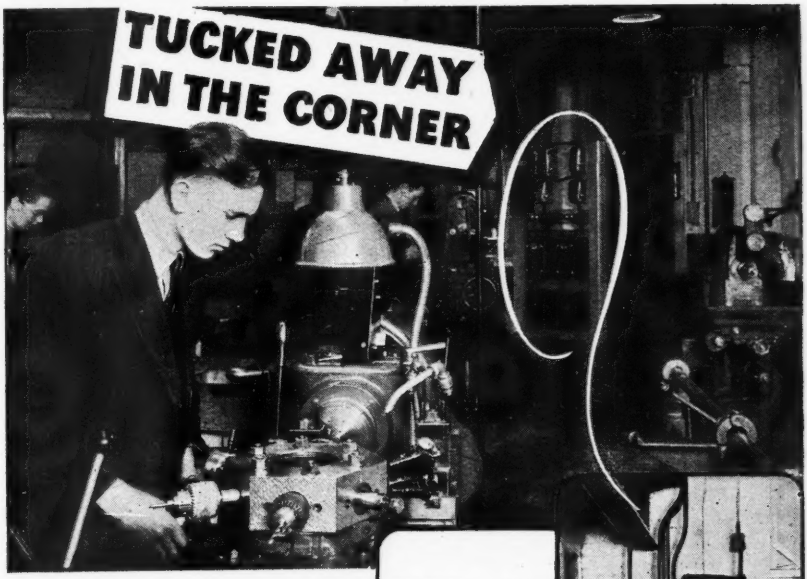

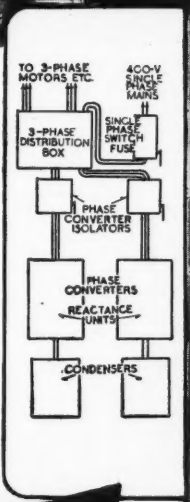

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Illustrated are two 4-kVA units operating in parallel and supplying the motors of two capstan lathes each with 2 H.P. motors, two capstan lathes with 3 H.P. motors, a centre lathe with a 2 H.P. motor and a 3 H.P. milling machine, a 1 H.P. grinder and an 0·5 H.P. drill, a total of 16½ H.P. The installation is at Messrs. Jelks, Holloway Road, London, and the wiring contractors were Messrs. J. W. Russell, of Watford.

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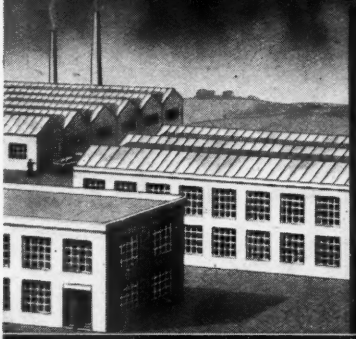

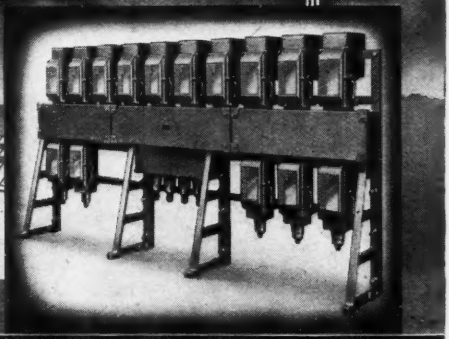

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B T-H

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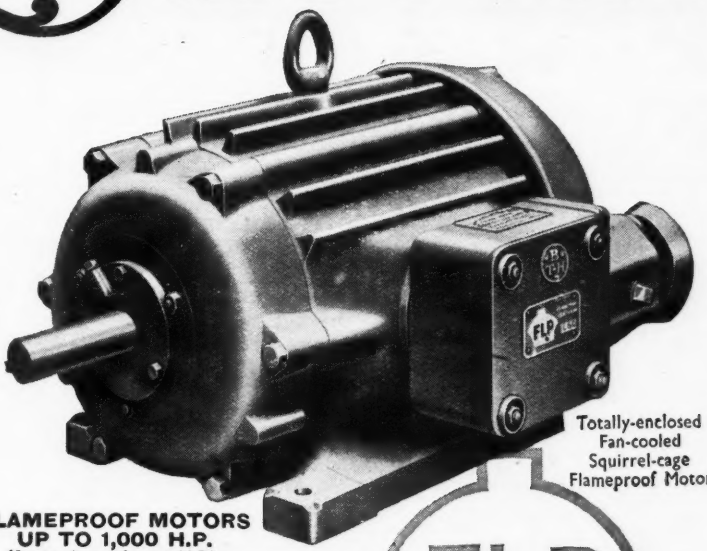

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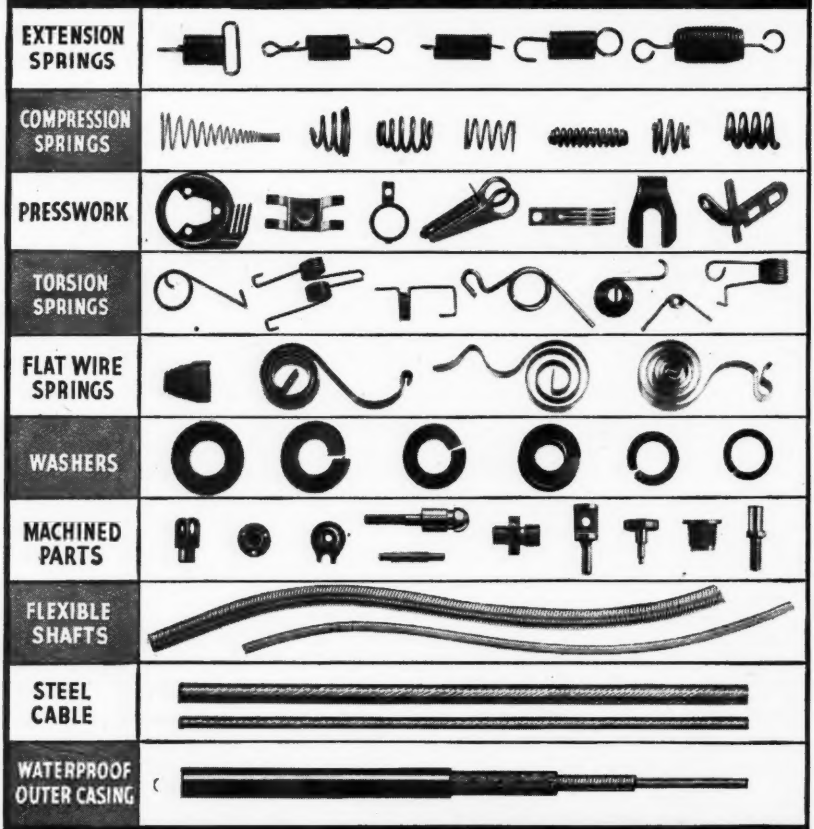

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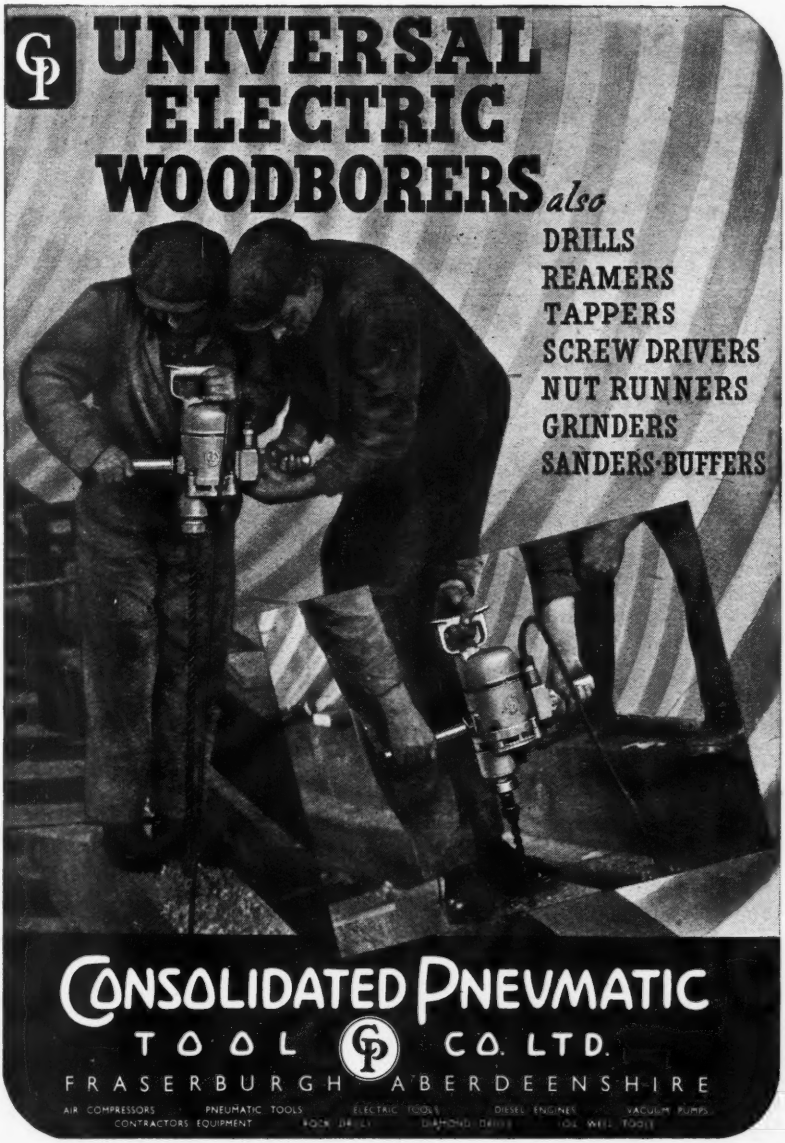
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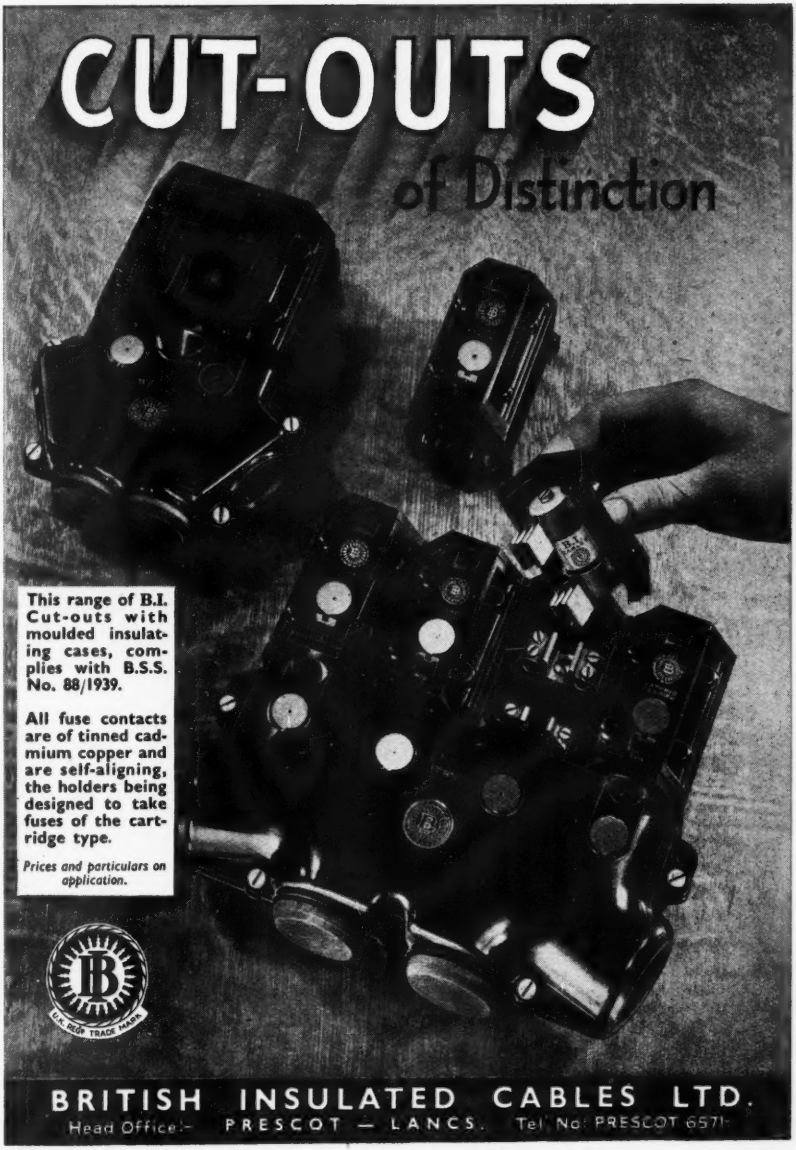
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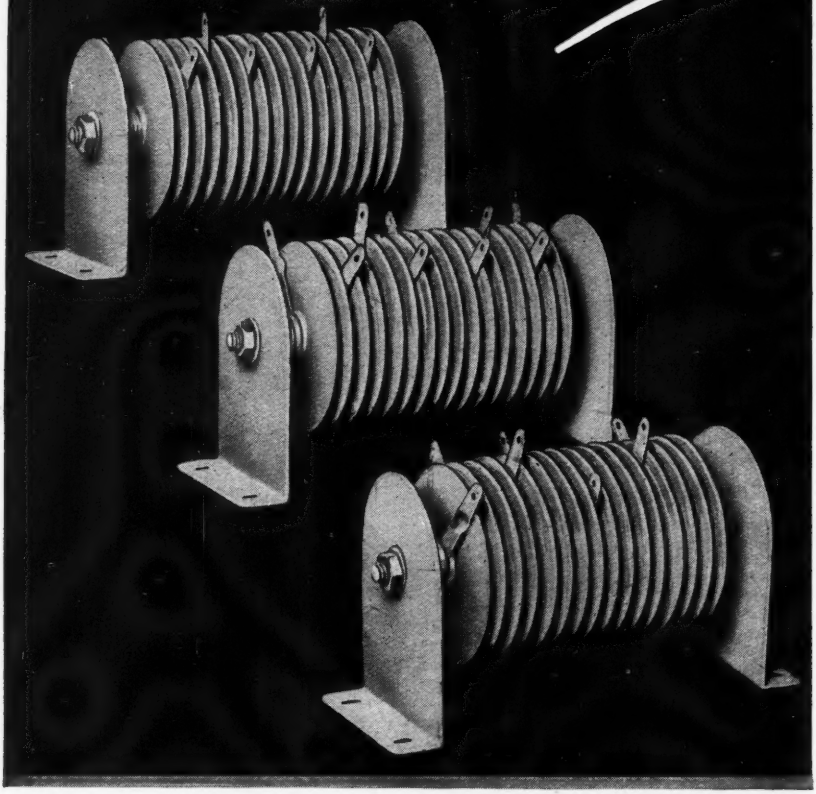

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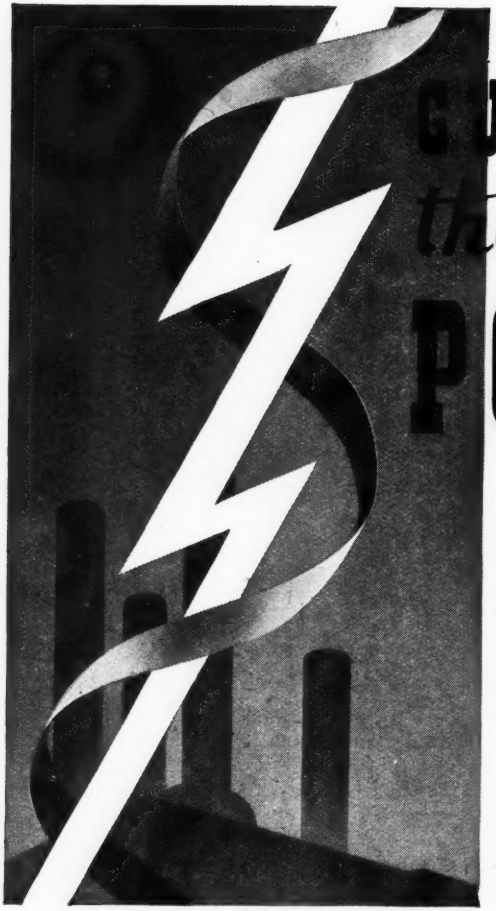

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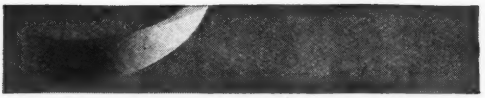

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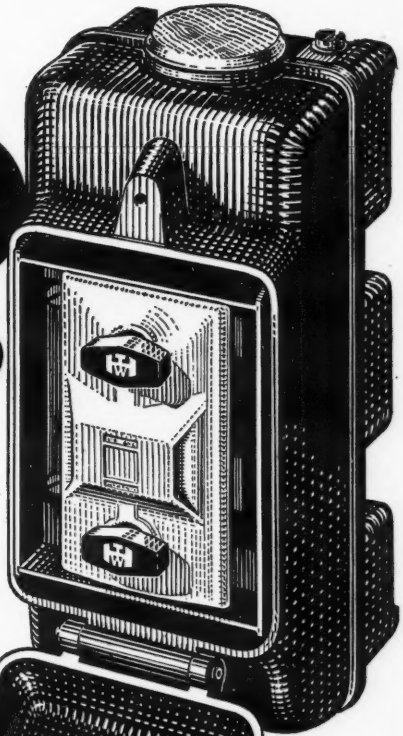

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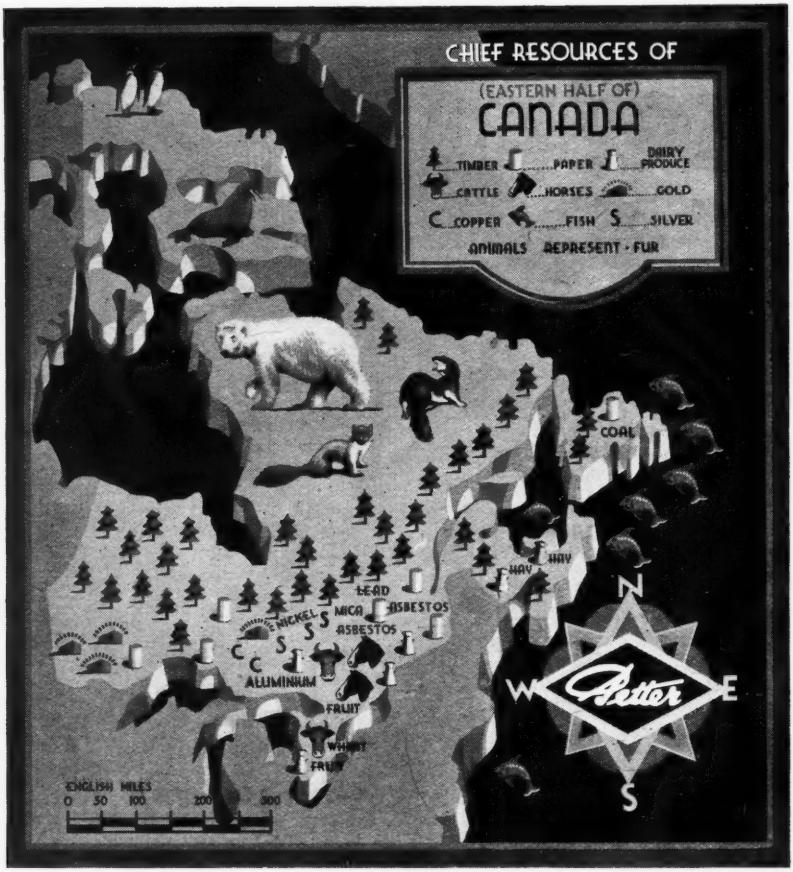

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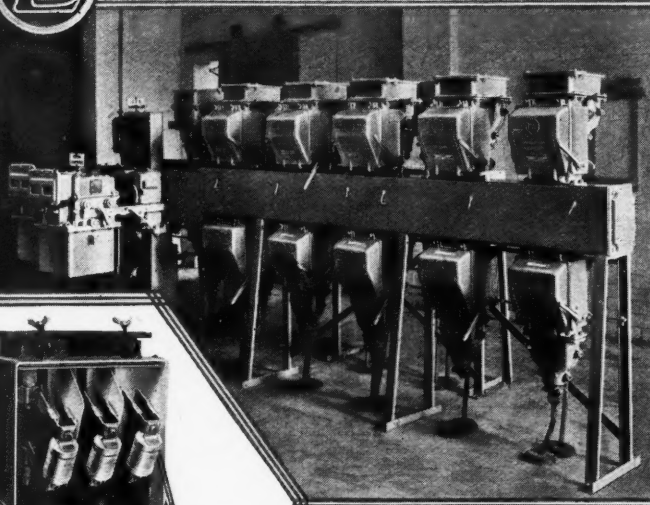

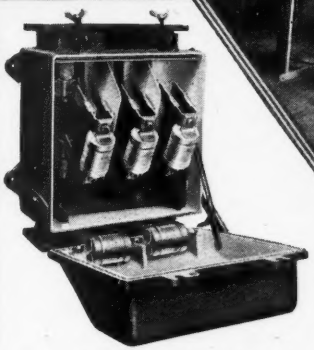

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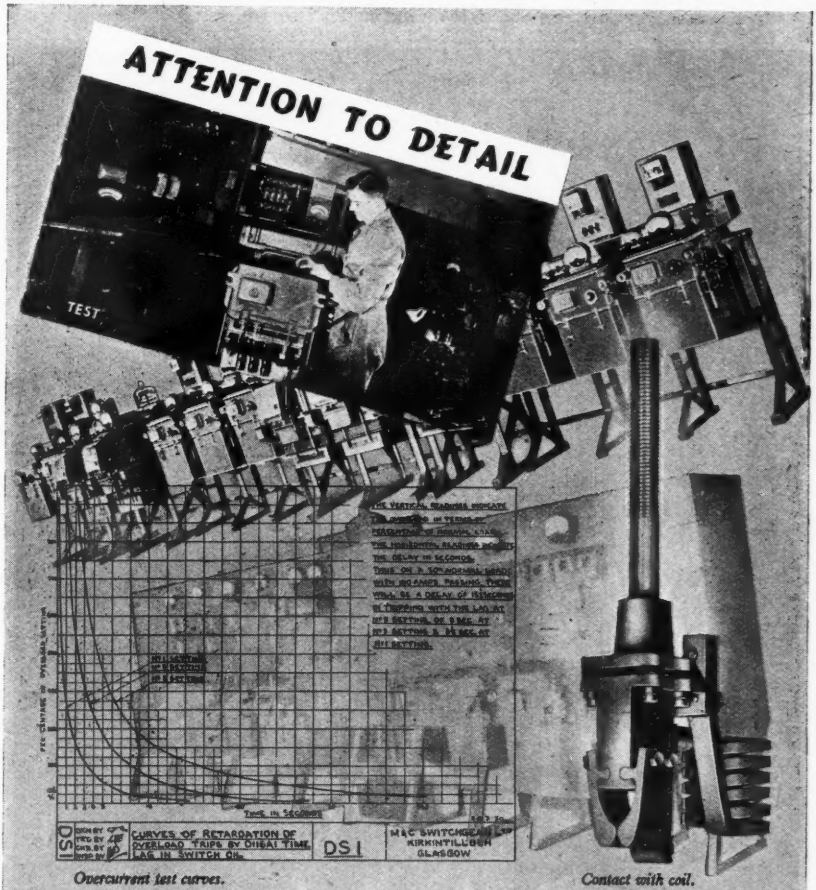

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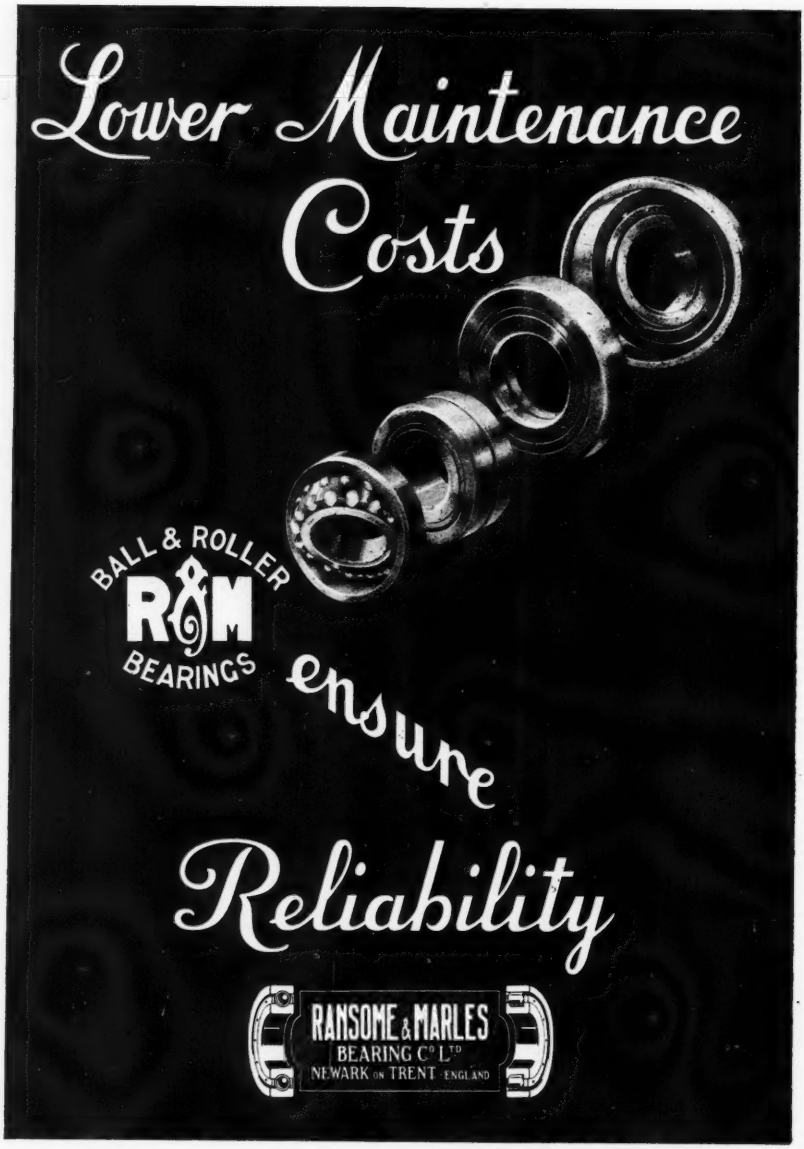
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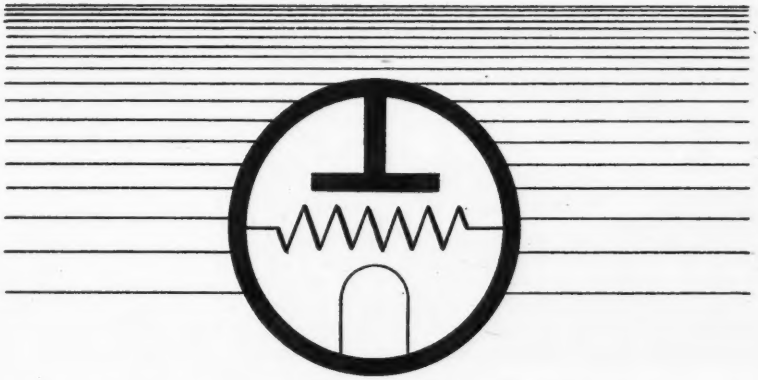

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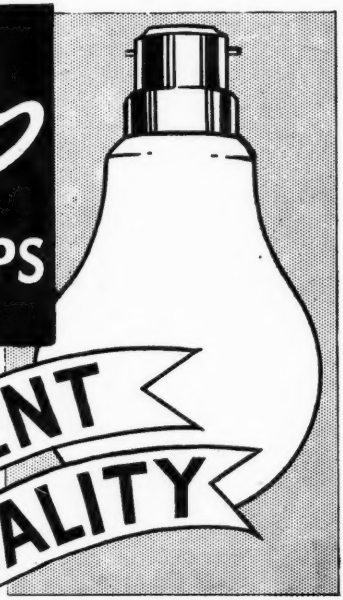

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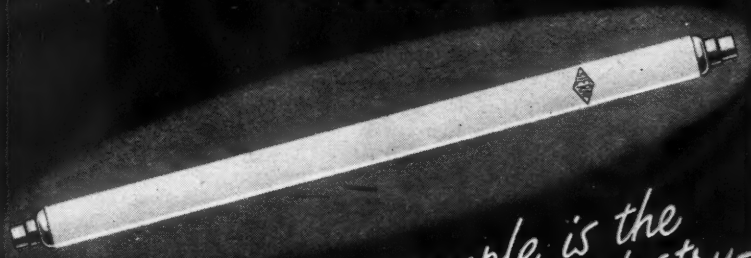

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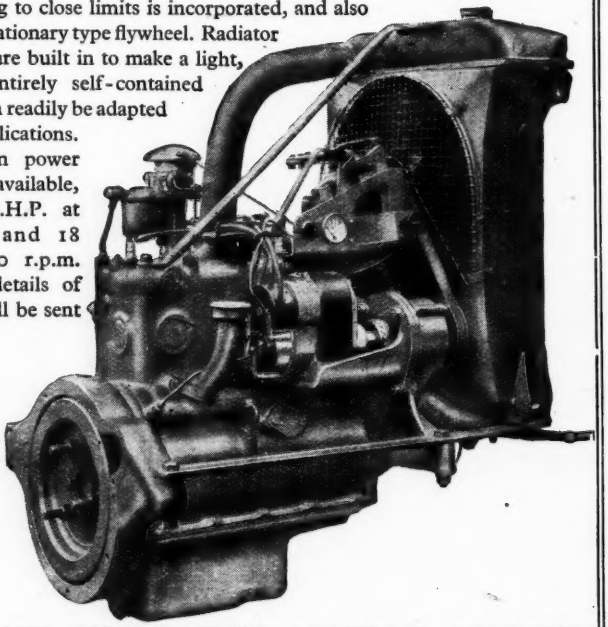

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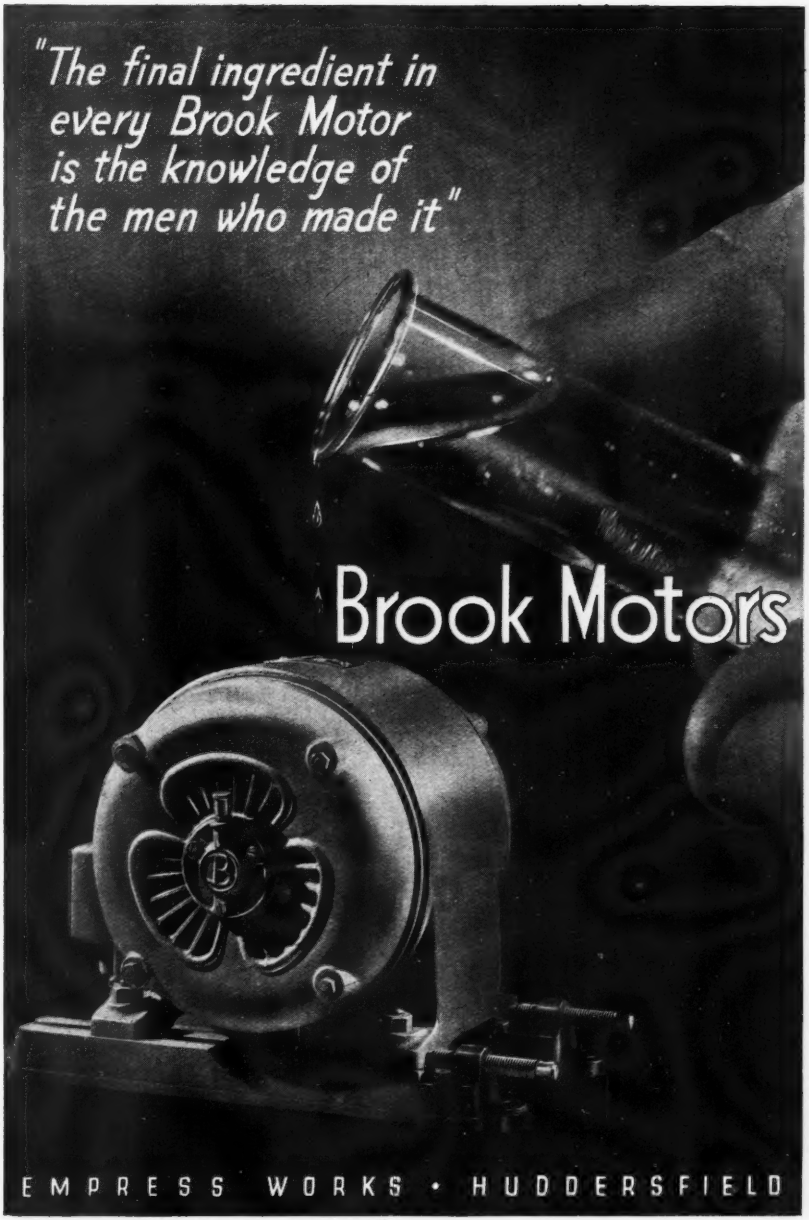
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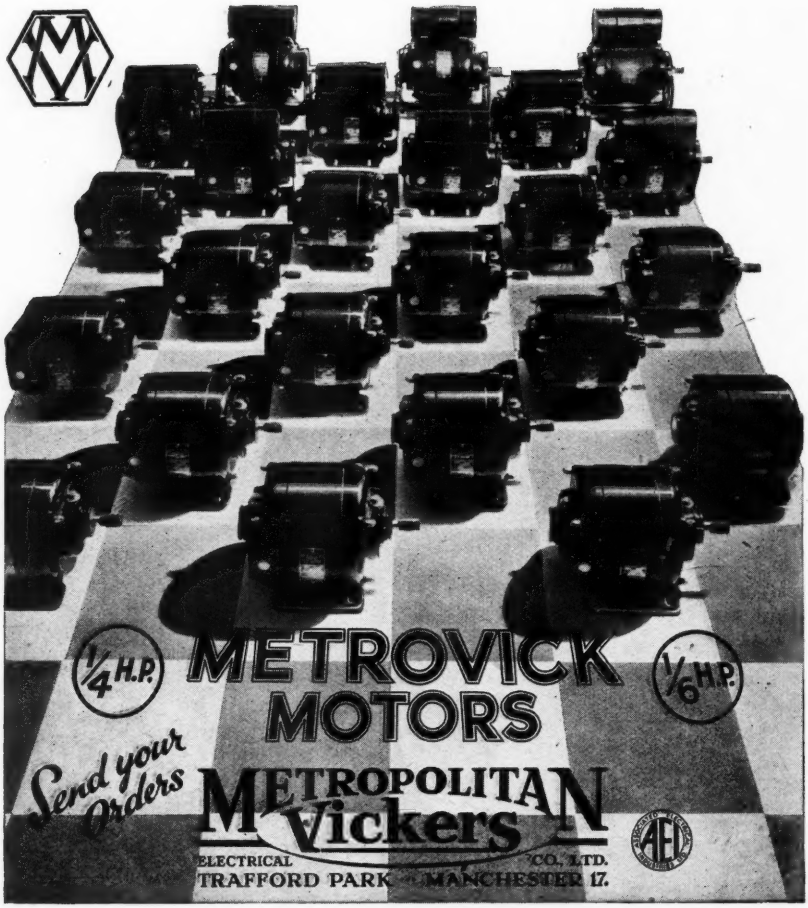

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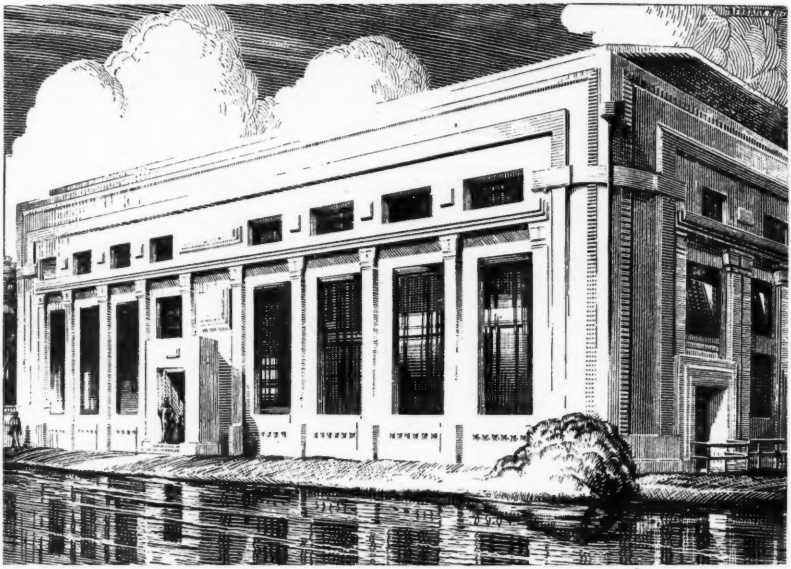

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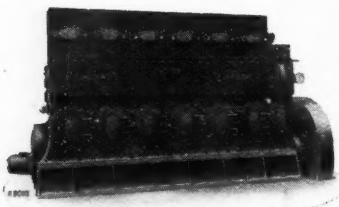

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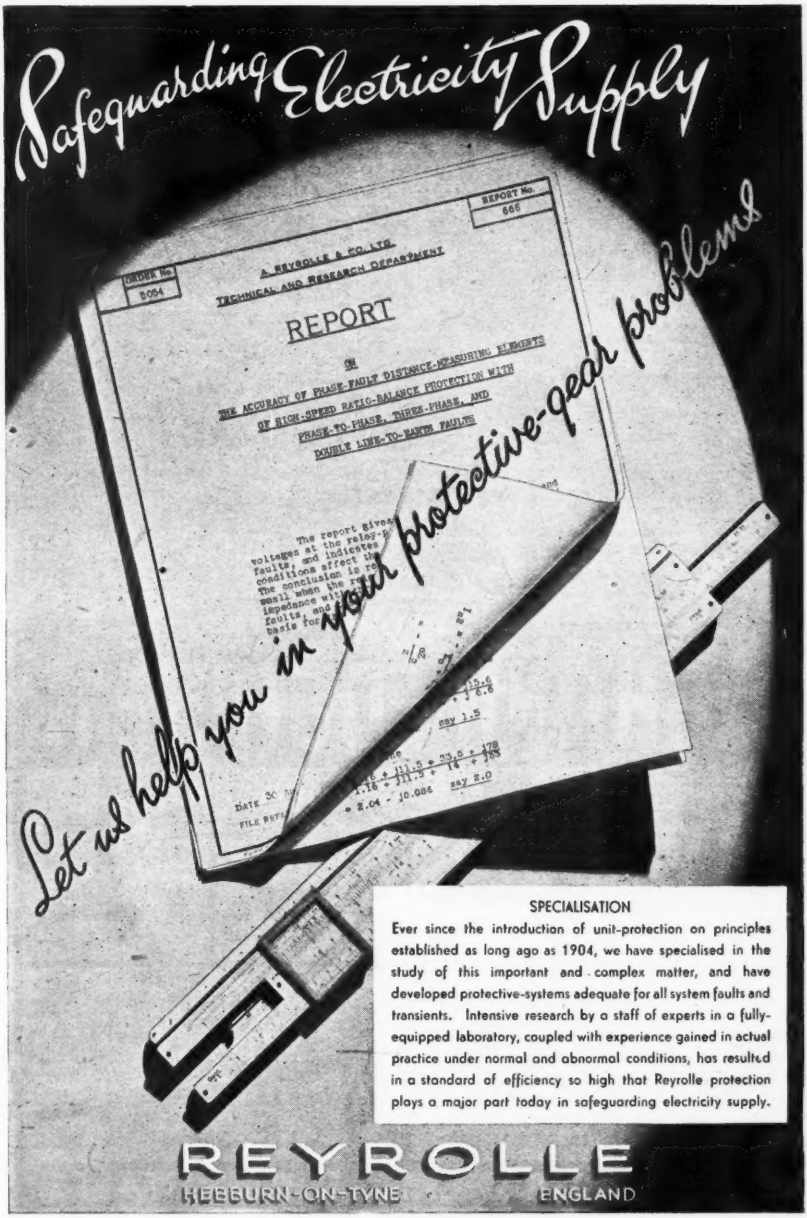
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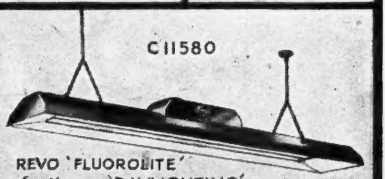

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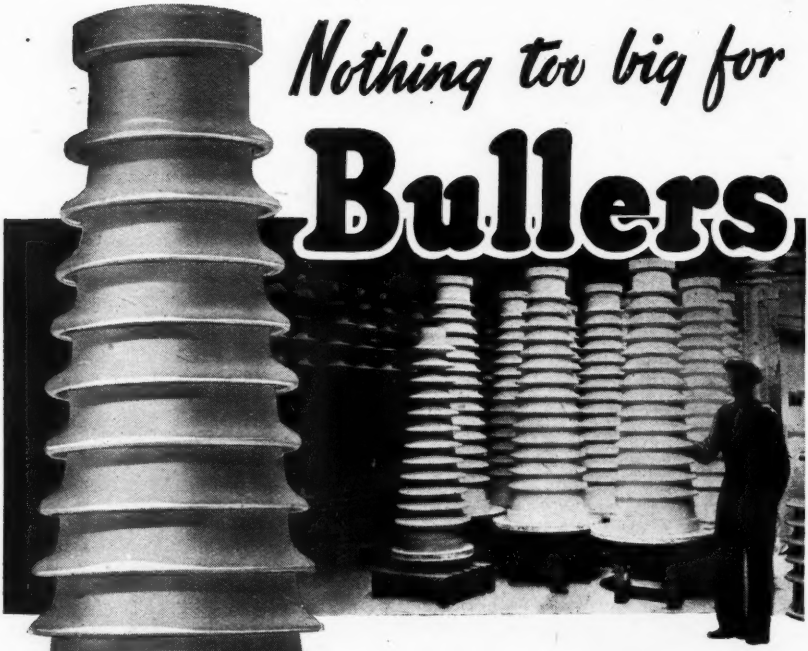

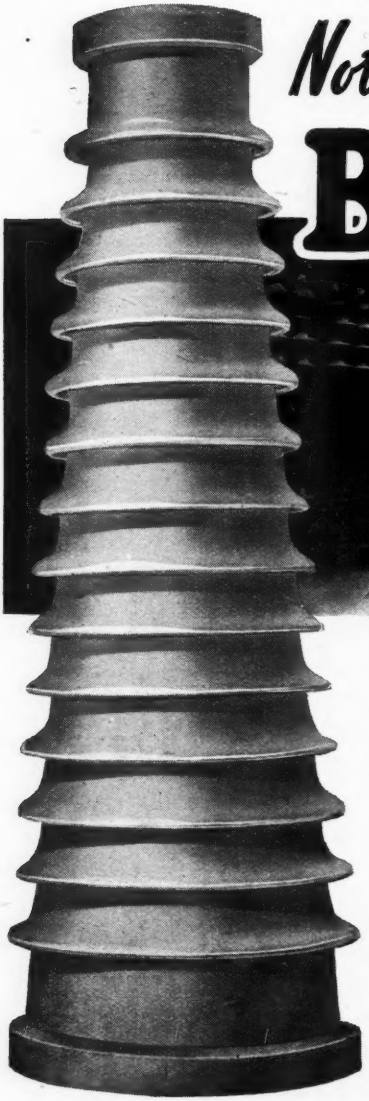

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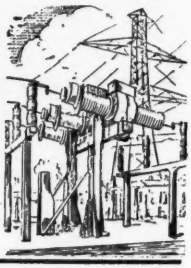

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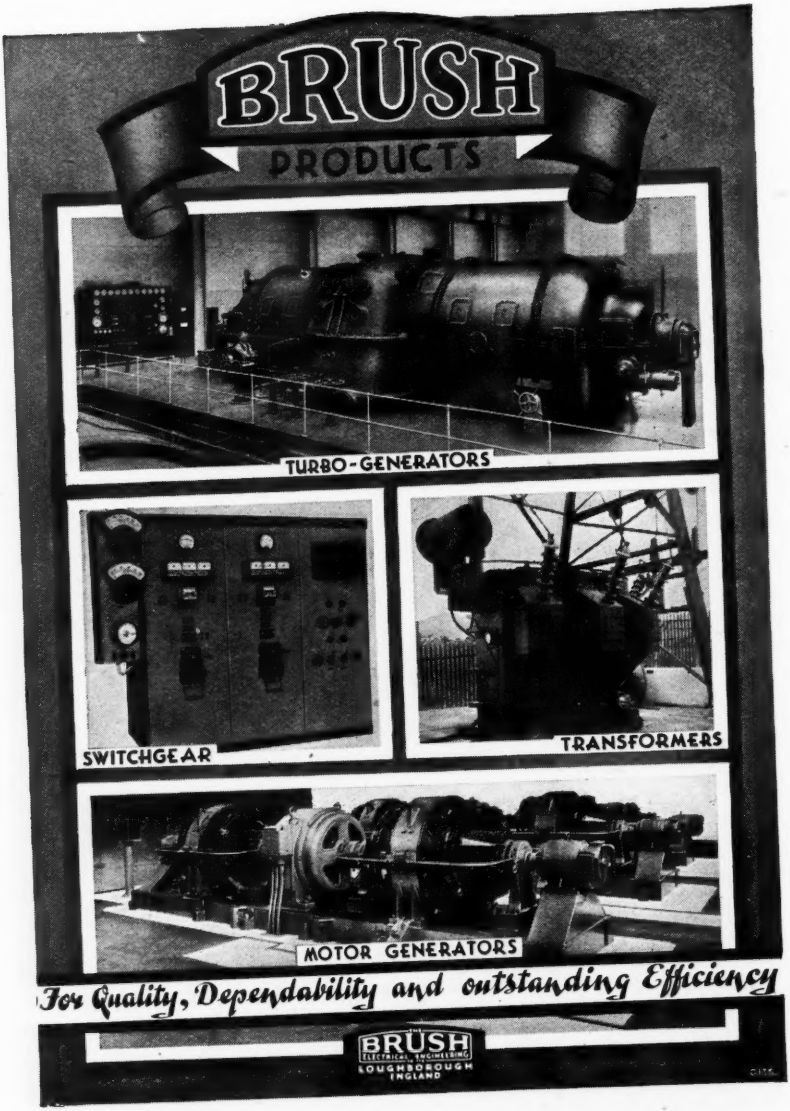
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ELECTRICAL REVIEW

Volume CXXXI — No. 3380

Friday, September 4, 1942

Contents

	Page
Editorial—The " Battle for Fuel "	289
Heavy Driving	291
Soldering Electrical Joints	294
Post-War Export Trade	295
Delta-Star Starting. By W. Acton.	296
Chemical Analysis—I. By H. J. S. Sand, Ph.D., D.Sc.	297
Power Factor Tests. By G. W. Stubbings, B.Sc., A.M.I.E.E.	301
Correspondence	303
Personal and Social	304
Classified Advertisements	61
Commerce and Industry	306
War Damage. By F. E. Sugden, A.C.I.S., Barrister-at-Law	309
New Books	310
Electricity Supply	311
Financial Section	313
New Patents	318
Train Lighting	319
The E.T.U. in 1941	319
Contract Information	320
Index to Advertisers	72

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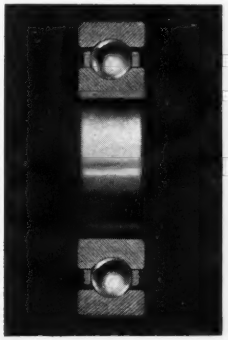

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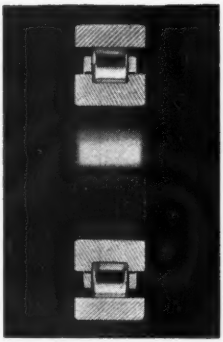

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The "Battle for Fuel"

Wanted—A Scheme that Will Work

LAST week we mentioned the endeavour of the Ministry of Fuel to get down to brass tacks by helping the consumer to calculate, and voluntarily keep within, the limits which it was sought to impose under the proposed fuel rationing scheme. But, as with everything else connected with the subject, difficulties have arisen.

Many object that the average householder cannot be expected to perform the simple calculations which are necessary. If this is true it is yet another reflection upon our educational system. Then, it is said, even if the arithmetic is successfully grappled with, slot-meter consumers will not know how much they are using—their gas and electricity are measured in shillingsworths and not cubic feet or kilowatt-hours.

Interchangeability of Fuels

Others point to the difficulty of ensuring that the separate amounts of coal, gas and electricity (and perhaps paraffin) total up to the allotted maximum. These points are, of course, just those which would appear to make compulsory rationing on the Beveridge lines unworkable without much confusion and hardship.

Hard cases proverbially make bad law which may be held to mean that if only a small number of people are adversely affected by legislation adopted for the good of the community as a whole then that legislation is justified.

It is probable that this is the case with the present scheme ; on the whole, for the small establishment, the allowance is not unreasonable and this class of household is preponderant.

But it has apparently been overlooked that, generally speaking, the larger the house the bigger the rooms and the adoption of a straight line graph as the Ministry seems to have done is not very satisfactory. We wonder what is to happen in the stately homes of England which cannot have fuel for more than seven rooms.

Arbitrary Division

Another unsatisfactory feature is the obstinacy with which the Ministry holds to the zoning method. Were the temperature maps studied before the arbitrary division was made ? It is obvious that if they were it was realised that any attempt to allocate allowances on such a basis was totally impossible. There is a wide area in the east of the Southern division which is far colder in winter than many districts in the Midlands and Northern zones. And even if the lateral zoning employed is considered to be a sincere attempt to even things out the great difference in the Northern and Southern allowances is unconscionable.

As we have said, all these arguments are against a rationing scheme but the fact remains that coal must be saved and destructive criticism is useless. Is there a reasonable and workable alternative ? We think that there is for a voluntary scheme, although it may be thought " reactionary."

The basis adopted for the original (1939) rationing Order was the consumption in a previous corresponding period. This was later abandoned for two main reasons. First, it was considered that the movements of people and the change in their circumstances made it generally inapplicable ; secondly, it was held to penalise those who had been economical and to favour the extravagant.

Now the movements of population have not been so extensive during the past year and most people have a firm basis on which they could plan economy. Therefore it is reasonable to suggest that they should be appealed to to reduce their consumption during the current year to three-quarters or even two-thirds of that during the corresponding period. This could easily be applied to coal, gas and electricity separately and the equivalents would not matter. The scheme is, of course, no more " watertight " than the Ministry's, but it is simpler and therefore has more chance of success.

Training for Export

IN an address last week (reported on another page) Dr. A. P. M. Fleming added his warning to those which have already been uttered regarding the conditions which will probably govern export trade after the war. The principal factors are the enforced industrialisation of former customer countries and the loss of our overseas investments. For a century or more this country has been fortunately placed for foreign trade ; after this war a far greater endeavour will be needed if we are to export enough of our manufactured goods to enable us to live at a reasonable standard. Dr. Fleming stresses the importance of market research which in the first place involves the proper selection and training of men for the purpose. Exporting firms will have to be prepared to spend money on this. Cheeseparing will result in failure.

Substitutes

IT is by no means easy to assess the virtues of wartime substitute materials and products or to define their characteristics. They are not infrequently so developed as ultimately to replace the original product. This is usually governed by commercial considerations, such as manufacturing facility, upon which depends the price purchasers finally have to pay. True substitutes are, however, in quite a different category. They are used only when anything better is temporarily difficult to obtain except at exorbitant cost. American manufacturers of incandescent lamps and reflectors, domestic refrigerators and heater tubes, cooker cabinets, thermostats, watthour meters, transformers and circuit-breakers for mounting on overhead line poles, do not doubt that some of the substitutes they have been introducing and the re-design thus necessitated will increase costs. But they are confident that the overall performance of the modified equipment will still be satisfactory. It is probable, too, that some of these changes will be retained after the war.

Women in Industry

ARRANGEMENTS, considered to be satisfactory, regarding the employment of women in the electrical industry have been made by the various sections. The action of the Executive Council of the Electrical Trades Union in agreeing to such arrangements was approved at the recent annual conference. The resolution effecting this laid stress on the principle of equal pay for equal work and referred to the encouragement of women to join the Union. The latter, it was stated, demanded the right to regulate wages and conditions for women workers irrespective of the trade in which they were engaged. Insistence was also placed upon the provision of the necessary amenities for women. The Amalgamated Engineering Union has also decided to admit women to membership.

Salvage

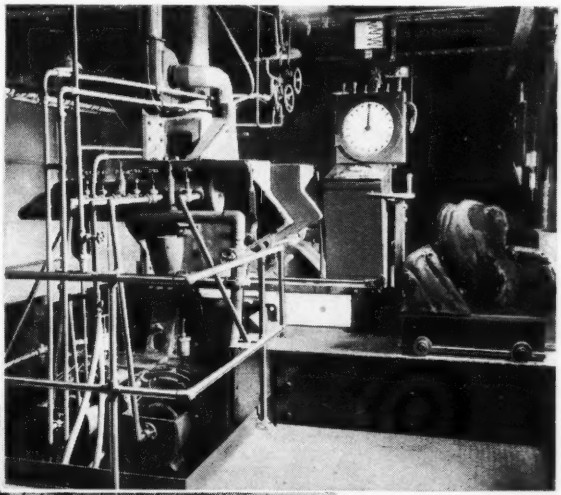
A REMINDER of what can be done in the way of saving scrap materials so important in the production of war equipment comes from the United States. Mr. George Sutherland, salvage manager for New York and New Jersey of the War Production Board said at the recent annual convention of the American Institute of Electrical Engineers that during the past year the nation's scrap dealers had collected 70 million pounds of aluminium (enough for 5,300 bombers), 26,000 tons of tin (enough for 150,000 airplane engines) and sufficient rubber to produce 12 million tyres. A third of the copper and zinc, and a fifth of the lead and rubber for war production came from salvaged materials.

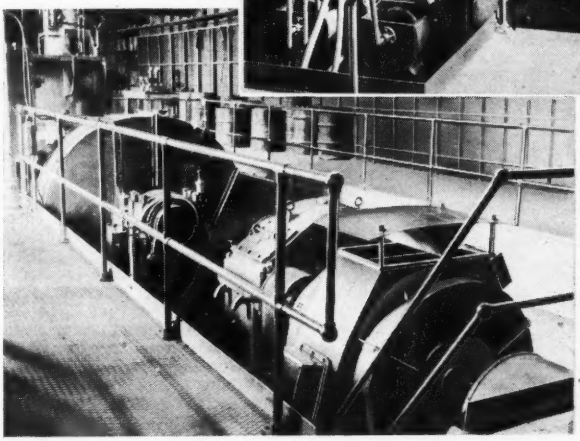
Heavy Driving

A New Rubber Mixing and Milling Installation

MIXING and milling in the rubber factory have long been regarded electrically as presenting the next worst possible driving conditions to iron and steel rolling, but after a recent visit to the works at Edinburgh of the North British Rubber Co., Ltd., to see the new rubber mixing and milling installation, we are inclined to think that advances in rubber-making technique have put them first. But while the modern tendency is to increase the load and speed of operation in rubber mixing, etc., hence the enormous peaks on the motors at starting, the advances in motor design and control are clearly shown by the less "fierce" running-up of the motors.

The mixer at the works referred to is a Banbury equipment. It is situated on the first floor of the building and is so arranged that the production flow is downward to the milling plant on the ground floor immediately below. It may be used either for breaking down raw rubber or for compounding, *i.e.*, mixing the various ingredients into the rubber at a later stage, but in either case the material is chute-fed into the chamber above the rolls where it is forced downward into the rolls by a compressed-air operated ram. This has an upward projecting plunger, operating within a cylinder externally surmounting the rolls chamber, to which air is introduced under hand-valve control from the works compressed-air system. A longitudinally sliding door under the rolls which permits the discharge of the masticated rubber is also compressed-air operated.

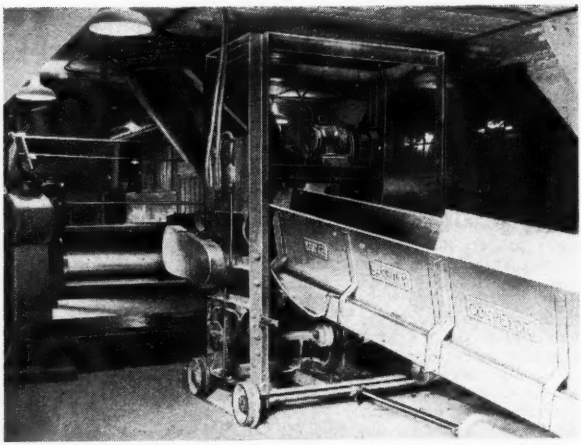




Above: The control station of the Banbury mixer is near the feeding chute to the rolls chamber
Left: The mixer is driven by a two-speed 500/250-HP motor through two sets of reduction gearing

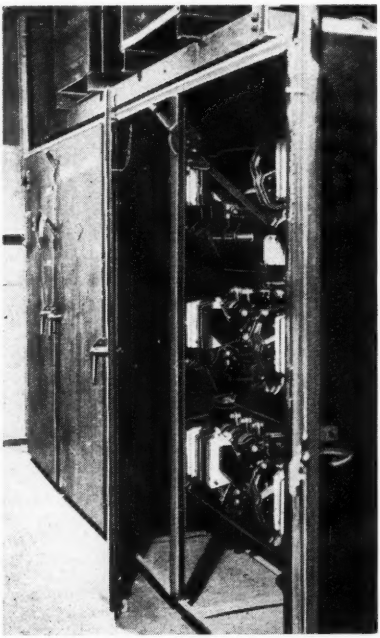
The rolls are placed side by side in the horizontal plane and they rotate in opposite directions, while the mastication process is rendered more effective by spiral ridges so placed on the rolls as to "engage" at their vertical faces. Two roll operating speeds are required, high for the initial masticating and

low for the compounding, so they are driven by a two-speed motor —1,000/500 RPM, 500/250 HP. Transmission is through two sets of enclosed reduction gearing in a series arrangement on to one roll shaft, transmission



The masticated rubber is passed to a special loading conveyor by which the material is fed to a sheeting mill (background)

to the second roll being provided for by a one-to-one ratio gearing between the two roll shafts at the far end. Both rolls are of the same diameter and thus have the same peripheral speed at any one time; on "high" they are arranged to rotate at the rate of 36 RPM.



All the mixer control contactors, relays, etc., are mounted on slate bases enclosed in floor-mounted sheet-steel cubicles

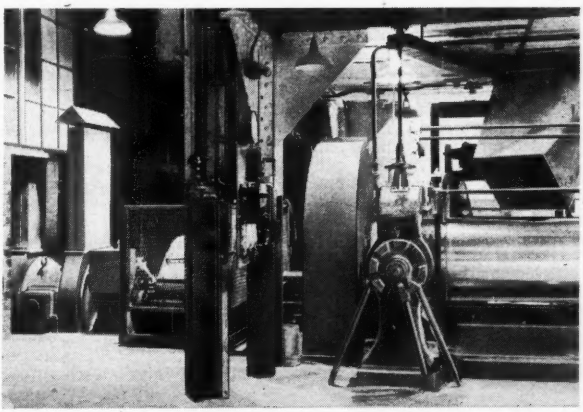
The slip-ring screen-protected English Electric motor has two sets of windings on both the stator and rotor, the two sets of slip-rings being placed one at each end. The slip-rings at the driving end represent a slight departure from normal practice in that they are inside the pedestal bearing, *i.e.*, between the bearing and the motor. Cooling is provided for by an internal fan at either end of the windings, the intakes being at the two end screens and the outlet at the top *via* a cowled discharge unit centrally arranged on the motor frame. This dual cooling scheme enables the machine to withstand 50 per cent. overload for half an hour. At four points on the stator thermocouples are fitted and these are brought out electrically to a terminal box with arrangements for readily connecting a portable temperature indicator. Other rather special features of the motor are the anti-chemical impregnation of windings and dust-proof bearings.

Motor Control Gear

Although the motor normally operates in one direction only the starting equipment includes a hand-operated combined interlocked isolating and reversing switch which is common to both the high- and low-speed windings. There are three magnetic overloads for each of the high-speed and low-speed stator windings, those for the high-speed being served by current transformers because of the greater current values. On each of the stator and rotor sides there is a pair of triple-pole contactors, one for the high-speed and the other for the low-speed windings, and in each case they are mechanically interlocked.

Rustless unbreakable rotor resistances surmounting the control cubicles are star-connected and arranged in six steps per phase,

all six steps being used when starting at high speed, but only the last four steps when running-up on low speed. Timing during acceleration is controlled by adjustable pneumatic timers coupled to the appropriate contactors—one for each starting step. All the contactors and relays are mounted on impregnated and bushed slate bases enclosed in floor-mounted sheet-steel cubicles with hinged front covers and easily removable back covers. On the front are mounted a selector switch to determine whether the starting



The 84-in. sheeting mill is driven by a 150-HP single-speed slip-ring pipe-ventilated motor

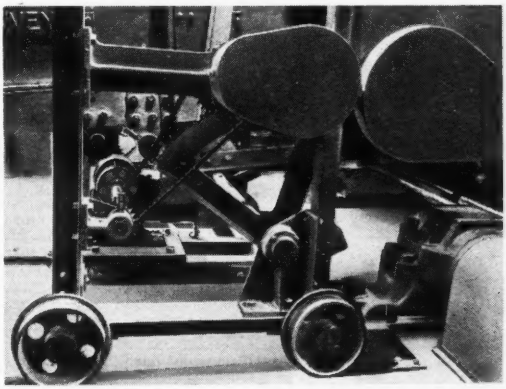
equipment shall be operated remotely from the push-button control desk at the machine operating platform or directly by the push-buttons on the front of the starting equipment. The starting station on the control cabinets has simple "high-speed," "low-speed" and "stop" push-buttons. A flush-type ammeter is also mounted on the cover. The control desk, in addition to the three-way push-button station, is equipped also with a flush ammeter and indicating lamps,

Movement of the quadrant imparts to the conveyor proper, through a crank, the final forward movement and the "lift"

a temperature indicator for the machine bearings, etc., and the various pneumatic controls. Igranic equipment is employed throughout the control scheme which, with the special features of the motor referred to, contributes to the successful overcoming of the difficulties associated with the very strenuous driving duties called for.

The masticated rubber from the Banbury mixer passes down a revolvable chute for directional feeding, normally to a special loading conveyor by which the material is fed to a sheeting mill. The conveyor is of the endless-belt type about 15 ft. long and inclined at about 30 deg. from the horizontal, with the upper and feeding end near the mill. It is supported on bogies which run to and fro on a short rail track. Upward projecting members at the sides of the conveyor belt constitute the sides of a trough hopper of which the belt forms the bottom.

As the rubber is fed on to the conveyor belt this is driven backwards, so that the rubber mixture builds up along the trough until the "charge" from the Banbury mixer is received. Then the whole structure is advanced towards the mill and the feeding end is raised so that the conveyor end-pulley is placed immediately over the rolls of the mill. The actual feed is then made by a reversal of the belt until the rubber is run off. The belt is driven by a small Lancashire reversible geared motor mounted on a platform above the belt. From



the gear shaft there is chain transmission to the belt pulley. At the lower end of the conveyor trough is a flap door which, to

prevent overrunning of the rubber on the belt when running backwards, operates a trip switch when it is moved by the rubber. The switch shuts the conveyor motor down. The to and fro motion of the conveyor unit is effected by compressed air through a cylinder and plunger equipment under the structure. The lifting motion is provided for by a small motor on the front bogie under the belt. From the motor shaft there is chain transmission on to a sprocket wheel which drives through a gear train a pinion wheel which engages a geared quadrant hinged to the bogie. Movement of the quadrant imparts to the conveyor proper, *via* a crank, the final forward movement and the "lift." All the conveyor movements are controlled from the operators' station at the mill front where there are Allen West push-button contactor units for the belt and lift motors and valve controls for the compressed air to the cylinder.

This 84-in. sheeting mill is driven by an English Electric 150-HP, single-speed, slip-ring, pipe-ventilated motor with transmission through two separate enclosed reduction gears on to one of the roll shafts, transmission between the rolls being effected by heavy gearing at the non-driving end. This gearing is of such a ratio as to give different rotating speeds to the respective rolls, while the different diameters of the rolls widens the divergence in the peripheral speeds of the rolls which, of course, rotate in opposite directions. The motor, line-shaft (after the first reduction), back-roll and front roll speeds are 583, 75.2, 19.1 and 13.8 RPM, respectively.

On the motor shaft between the motor and the first reduction is an electro-magnetic brake which is energised with the motor and applied under spring influence as soon as the motor is switched off. Placed longitudinally above the rolls within easy reach of the operator is an emergency trip rod, downward pressure of which actuates, through a crank arm at the end, a push-button switch which, in turn, breaks the maintaining circuit in the starter, thus de-energising the electro-magnetic brake.

The Igranic starter equipment includes a hand-operated interlocked isolating switch, a reversing switch, a stator contactor, three magnetic overloads, four rotor contactors and pneumatic timers. At the front of the sheet-steel cubicles are the "start" and "stop" push-buttons and a flush mounted ammeter, while surmounting the cubicles are the rustless unbreakable starting resistances. At the operators' station on the machine are additional start and stop push-buttons.

We are indebted to the managing director of the North British Rubber Co., Ltd., for permission to visit the works and to take photographs, and to the engineering staff for help in collecting the above information.

Soldering Electrical Joints

THE author of the article bearing this title (*Electrical Review*, August 28th) has sent us some supplementary notes on the effect of the War Emergency Specification No. 219, 1942 recently published by the British Standards Institution. This aims at reducing by 50 per cent. the amount of tin used in soft solders and it reduces the number of grades from the twelve shown in the author's Table I to the five set out below.

BRITISH STANDARD WAR EMERGENCY SOFT SOLDERS, 1942

Grade	Composition %			Use.
	Tin Max.	Anti-mony Max.	Lead	
C	40	2.40		Tinsmiths', coppersmiths', fine work, general work.
D	30	1.70	The remainder	Lead cable wiped joints, plumbers' wiped joints.
G	42	0.40		General electrical purposes, tinned electrical joints, zinc and galvanised ironwork.
M	45	2.7		Special tinsmiths' fine work and hand soldering.
N	18.5	1.0		Dipping solder for radiator manufacture, etc.

The Institution points out that changing the grade of solder may cause some initial inconveniences and need some trials and tests to obtain the best working technique, but "Micofarad" says that from his experience he thinks that the grades D and G specified for electrical uses are unlikely to cause any trouble either in use or in service.

Of course if a solder having a *lower* tin content than specified is in satisfactory use, then its use should obviously be continued. Special sanction will be required to use solders having a higher tin content than that given in the table.

It may be noted that the characteristics of Grade G, the non-antimonial solder now specified for general electrical purposes, and those of Grade F previously specified for the same purpose are both given in Table II of the article and can readily be compared.

In the section "Melting range" in Table III of the article the "solidus" and "liquidus" headings were transposed.

Exports to Middle East

THE Board of Trade has made the Export of Goods (Control) (No. 35) Order, 1942, prohibiting, as from September 14th, all exports to Aden, Anglo-Egyptian Sudan, Cyprus, Egypt, Palestine and Trans-Jordan except under licence. Copies of the Order (S.R. & O. 1942 No. 1676) are available at the Stationery Office, price 1d.

Post-War Export Trade

Importance of Research and Personnel

FACTORS likely to influence the nature and course of British export trade after the war were surveyed by Dr. A. P. M. Fleming (Metropolitan-Vickers) in an address last week to members of the Engineering Industries Association. During the war many new factors had arisen, he said, which gravely imperilled the future of export business. The problem was of concern to the entire community, ultimately determining whether we exported goods or population.

Our export business had been built up on the mineral resources of this country and it was facilitated by our great overseas carrying capacity. Our whole economic position had been strengthened by our overseas investments. These assets had diminished in value and in some respects had vanished entirely. It had been demonstrated that industries could be set up anywhere when raw materials, labour and capital were available. Huge manufacturing facilities for war purposes had been established in Australia, India, South Africa and Canada and these could be converted to peacetime production. If the local population was too small to absorb the products, goods might be exported to neighbouring areas.

In this address Dr. A. P. M. Fleming stressed the need for the thorough study of export markets and the careful selection and training of technical and commercial staff

Then, again, international trading might be on a new basis. Such matters as "lease-lend," and the possible rationing of raw materials (and perhaps even manufacturing facilities for a while) throughout the world would provide experience which might shape a new international trading policy in which tariff barriers might present an entirely new significance. These things made it impossible to draw up specific plans for the future but it was worth while paying attention to two fundamentals in everything relating to production and distribution—research and personnel.

Research did not mean merely laboratory experiments ; it was the scientific approach to every aspect of the production and distribution of commodities. It meant the careful study of markets, including the purchasing power, tastes and needs of the people concerned, investigation of the transport and distribution methods and the question of credits.

In manufacture research concerned itself with the selection and search for the most suitable and economic raw materials ; with the processes of conversion of these materials so as to eliminate waste of time, money and effort ; the study of the best use of the human element ; and the application of the ever-growing new scientific knowledge to the evolution of new processes or new products.

If we were to hold our own in world competition, should the competitive system prevail, it was important that we should be in advance with every new type of product that might apply to the particular market with which we were concerned, and moreover, that we should be able to supply that product of the right quality and at a competitive price.

All these activities depended upon personnel. Modern conditions had depleted our supply of skilled artisans and at the same time, in spite of the expansion of educational facilities, there was an insufficient supply of young people with good secondary education. Although mass production had operated against the need for certain types of skilled artisan, the provision of the tools for production called for an even greater degree of skill than heretofore. Apart from the importance of training the manual worker it was necessary to educate and train those who would be concerned with the design, development and manufacture of ever-improving products. In this connection there was much to be done in readjusting our system if we were to retain and improve our technical capacity so as to outstrip our competitors in the export markets.

Overseas Students

Another matter which had not been explored to the utmost was the attraction of young men from user countries to be trained in our industrial organisations. There was, of course, a risk that such men might return and set up rival production in their countries. On the other hand they could become the best missionaries of the products in connection with which they had been trained. Many British firms doing a large export business had adopted this policy and had found it to pay.

The research problem to-day was not merely one of developing new knowledge, important though that was, but of utilising the available knowledge. In this connection every concern, however small, would be well-advised to have on its staff one person

at least so equipped as to be able to study all new technical knowledge in relation to the business and see that it was effectively applied to market research, research relating to existing production or the possibilities of entirely new developments.

Similarly, each concern, through its personnel manager, should keep in touch with developments in the education and training of personnel and ensure that the young people were trained in the most efficient way whether in production or commerce. Perhaps above all was the need for attention to the preparation and training of the personnel which would eventually occupy the highest positions in the organisation. Young men showing administrative or executive ability should be earmarked as early as possible and their experience broadened, where export was concerned, by sending them overseas to enable them to become familiar with export markets.

If the factors of personnel and research were recognised in their proper perspective and applied with courage and enterprise in a world that might have become war-weary, there need be no misgivings as to whether goods or population were to be exported.

Delta-Star Starting

A Means of Reducing Energy Consumption

By W. Acton

FUEL economy campaigns have not mentioned the appreciable saving of kWh consumed that might be accomplished by reconnecting existing motors that are normally lightly loaded so as to enable them to run in " star." Have the many cases in which " star-delta " starters work the wrong way round been considered?

Modern production methods make use of a considerable number of presses and shears which do their work by virtue of the energy stored in revolving flywheels. Their driving motors have to develop sufficient torque to accelerate the flywheels in a reasonable time, after which the motors continue to run comparatively lightly loaded. Under running conditions any such motor could very easily perform its duty at 57 per cent. of the normal voltage; that is in " star " connection. Their magnetising current would be very small; consequently the power factor would be much better and the kWh consumption would also be reduced considerably as the losses that occur within the motor would be smaller.

" Star " Running

In these cases the correct method is to switch the motor " direct-on " (" delta ") for starting, and change to " star " for running; or, if starting current is an important consideration then start " star-delta," but come back to " star " for running. The speed-torque characteristic of an induction motor in " star " is more suitable for a flywheel type of drive than its equivalent characteristic in " delta."

In the case of a shear, which is called upon for one operation every five minutes or so, the stored energy in the flywheel will perform the actual shearing operation, so that the motor has ample time to accelerate the flywheel to its normal speed before the next shearing operation is performed.

Care should be taken in applying this suggestion, as certain factors concerning induction motors need to be considered. The torque of the motor varies as the square of the applied voltage; therefore, in " star " only one-third of the torque is available. It should be remembered, however, that this is one-third of the maximum torque, so that in a normally designed motor it is about 70 per cent. of full load torque. This torque is often sufficient for the duty.

Tests on a 5-HP motor running light gave the following figures: total no-load loss in " delta," 504 W; in " star," 293 W; power factor in " delta," 0.153 and in " star," 0.42. The saving in watts being 211, on the basis of 60 hours per week, it represents an economy of 12.66 kWh per week. Multiply this by the number of such presses operating in the country to-day, and the saving will appear to be very substantial. The power factor shows a decided improvement, which would reduce the kVA demand quite appreciably in a factory where a number of presses are installed.

It is suggested that where such drives are used a test be made to ascertain whether the press will operate successfully with the starter held in the " star " position after having started normally; if so, the next step is to arrange for the starter to be re-connected to give the revised operation, *i.e.*, the no-volt and overload releases in the " star " position.

Another aspect of this proposal is that there are operating in our industrial factories many motors which are working at loads round about 40 to 50 per cent. normal full load. All these machines could be re-connected " star " if their normal connection is " delta "; thus saving much energy and reducing the kVA demand.

Chemical Analysis—I

Polarographic Theory and Procedure

By Henry J. S. Sand
Ph.D., D.Sc., F.I.C.

(The author, until his recent retirement, was Head of the Department of Inorganic and Physical Chemistry and Lecturer on Electrolytic Analysis at Sir John Cass Technical Institute, London)

POLAROGRAPHY, a method of chemical analysis by electrical means, automatically furnishes permanent records of both the nature and amount of the constituents of solutions, while several components may be determined in one estimation. The method is practised in industrial laboratories concerned with agriculture, alcoholic liquors, dyeing and bleaching, ceramics, explosives, gases, non-ferrous and ferrous metals, oil, soap, sugar, water purification, sewage treatment, etc. (See bibliography).

The volume of liquid needed for tests varies according to the kind of cell utilised from about 10 c.c. to as little as three drops, which may be used over again for confirmation of a first record. The electrolytic cell employed contains one extremely small and one large electrode, made of the same metal. The steadily increasing potential difference applied to them as well as the minute current that flows through the cell are registered.

The Heyrovský method differs from earlier similar ones in that both electrodes are of mercury, the smaller one consisting of a droplet that slowly emerges from a fine capillary and after an interval of a few seconds drips into and is absorbed by the large "pool" electrode. The droplet is replaced by a similar one supplied from a reservoir under a head of about 60 cm. of mercury.

Heyrovský at first read the current directly, but in 1925 in conjunction with Shikita he made the method automatic and thus invented the polarograph. The steadily increasing potential was taken from a wire wound on a revolving drum while the current which was measured by a sensitive galvanometer was recorded photographically on another drum mechanically coupled to the first. The curves thus obtained are polarograms, their abscissæ representing the voltages applied between the dropping and the large mercury electrodes and the ordinates representing the corresponding currents.

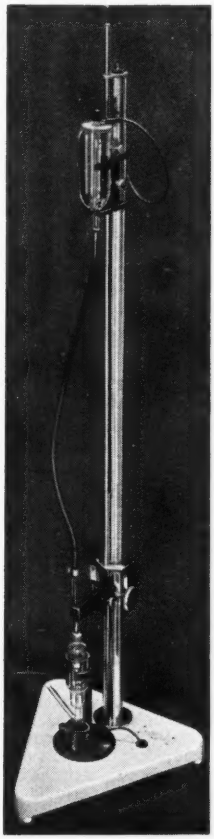


Fig. 1.—Cambridge electrolytic cell with its reservoir

The curve second from the bottom in fig. 2, obtained with a normal solution of sodium chloride, or one of a concentration of 58·5 grams of NaCl, per litre of solution shows that for the initial small applied voltages hardly any current passes through the solution. When $-1{\cdot}9$ V is reached a sudden very large increase causes a "bend" in the curve, which would go on beyond the range of the diagram after which the polarogram flattens out and continues in a form corresponding to that before $-1{\cdot}9$ V.

The bottom polarogram, obtained with a solution of one tenth the concentration of the first, differs from the former primarily in that the bend takes place a little later. The explanation is that the increase in the current at $-1{\cdot}9$ V is due to the fact that that voltage is required to liberate the metal sodium from the aqueous solution. The sodium deposited into the droplet forms an amalgam with the mercury; if it did not, a voltage so negative would be required that, instead of metal, hydrogen in unlimited quantity would be liberated. Assistance is also provided by the high over-potential of mercury, meaning that hydrogen is liberated on a mercury cathode at a much more negative potential than on most other metals. Other advantages of the mercury electrode arise from its uniformity of surface due partly to the use of pure material and partly to the continuous replacement of the droplets by fresh ones.

The fact that the liberation of sodium from the more dilute aqueous solution takes place at a slightly more negative potential than from the more concentrated one is due to the fact that the equilibrium of a given sodium amalgam at ordinary temperature with

a solution which contains sodium ions is governed by the " Nernst " equation:—

$$E = E_0 + 0{\cdot}058 \log (Na+) \text{ volt.}$$

in which E is the electrode potential, E_0 depends on the concentration of the sodium in the amalgam and (Na+) means the concentration of the sodium ions in the aqueous solution expressed in gram-ions per litre.

At ordinary temperature the reduction of the concentration of sodium ions to one tenth of its value makes the equilibrium potential more negative by 0·058 V. Equilibrium potentials and those at which metals are deposited into mercury are indistinguishable, so that the bend in the curve marked 0·1 norm. should be at a position 0·058 V more negative than in the curve marked NaCl norm.

The top curve is the polarogram of a solution containing, like the first, 53 g NaCl with an additional trace of a lead salt amounting to 10^{-4} g-equivalent, or 0·0104 g of lead ions per litre. At about −0·4 V a large increase of current takes place due to the deposition of lead in the mercury cathode. After this, on making the electrode potential still more negative, the current again assumes an almost constant value until the sodium bend is reached at the same potential as for pure sodium chloride.

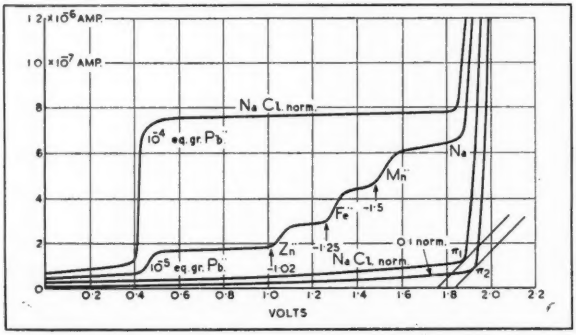


Fig. 2.—Simplified smooth curve polarograms indicating change of direction with current increase

The constant current just mentioned corresponds to a state around the droplet in which the concentration of the lead ions in the layer of solution immediately adjacent to the mercury is practically zero, whereas at a very short distance from it separated by a thin " diffusion layer " the concentration is still the same as that of the bulk of the solution. The current carried across the surface of the mercury drop is due entirely to the discharge of lead ions and thus depends only on the rate at which they diffuse through the layer. It is proportional to the concentration of the lead ions in the bulk of the solution. The difference between the current at which lead ions begin to be discharged and that at which it assumes the value of the diffusion current is known as the " height of the step " corresponding to lead.

Making certain assumptions Heyrovský mathematically worked out the shape of the steps and found that half-way in them there is an inflexion point the position of which is independent of the concentration of the metal ions in the solution, the rate of dripping, the current, etc., and is therefore characteristic of the particular metal (lead).

The " step " is symmetrical about a line drawn through the inflexion point perpendicularly to the plane of the paper in such a way that it remains unchanged after rotation through 180 deg. around this line. The step is everywhere continuous so that its beginning and end may be arbitrarily chosen. The positions at which the slope of the curve is 45 deg. and points of maximum curvature corresponding to a slope of 35 deg. 16 min. have been used, but the most usual procedure is described later.

The second polarogram from the top (fig. 2) was obtained with a normal solution of NaCl to which traces of lead, zinc, ferrous iron and manganese, each in a concentration of 10^{-5} gram - equivalent per litre were added. As the potential required for the discharge of each additional ion is reached a new " step " makes its appearance and the ion is liberated in addition to the preceding ones. The 45 deg. " tangent potential " is indicated for each constituent, being the point where the slope of the curve is 45 deg. The effect of concentration on the height of the step will become evident on comparing the steps for lead in the top and in the second polarograms. The former is ten times as high as the latter in agreement with the ratio of concentrations in the two cases.

Though the curves shown in fig. 2 have been made smooth for simplification, yet in actual fact they are serrated (fig. 3) owing to the periodic growth and disappearance of the mercury droplets. The voltage measured is the sum of E_1 between the dropping electrode and the solution, the ohmic drop iR required to force the current through the solution, and E_2 between the solution and the large electrode. It is only E_1 that is of interest; iR is usually negligible, being kept as small as possible by making the resistance R of the

solution small. This is done by maintaining in the test solution an overwhelming excess of an electrolyte, which undergoes no decomposition over the range of potential required. Thus in the top and second polarograms the " basic ", " indifferent ", or " ground ", elec-

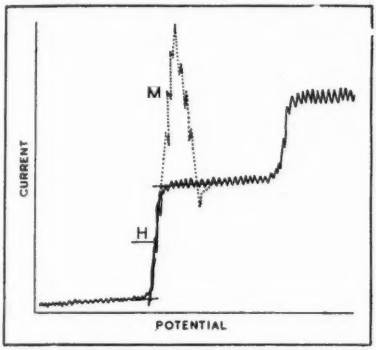


Fig. 3.—Typical serrated polarogram indicating maximum M and half-wave H zones.

trolyte is ten thousand times as concentrated as the test substances. The latter do not take part to a measurable extent in the conduction of the current through the interior of the liquid so it is only in the passage from electrolyte to electrode that the current is carried exclusively by them. To the current passing from the electrolyte to the electrode must be added one due to the " condenser " effect of the mercury droplets; the surface of each droplet acts as a capacitance which must be charged to the potential E_1. The " condenser " effect plus the ohmic resistance effect may result in a slight upward slope of the polarogram.

Owing to the relatively large surface of the mercury pool, electrode E_2 remains constant during a determination. Its value depends on the somewhat fortuitous concentration of mercurous ions in immediate contact with the pool. When absolute values of half-wave potential are required they may be obtained by determining the potential difference between the pool and a subsidiary standard electrode; or else a suitable amount of a substance of accurately known half-wave potential, usually a thallium salt, may be added to the test solution.

What might seem to be a source of difficulty is the formation of so-called " maxima " in the form of sharply pointed waves often many times as high as those belonging to the test substance. They usually occur at the place where the diffusion current should set in (dotted portion of fig. 3). Heyrovský proved that maxima are reproducible and traced them to the presence of traces of substances which are adsorbed to the surface of the mercury droplets and there reduced. They can be suppressed by the addition of some other adsorbable substance which displaces the one causing the maximum, but is not itself reduced at the voltage in question. Therefore most prescriptions for polarographic operation advise the addition in small quantity of gelatin, starch, etc.

Apparatus may usually be purchased ready-made from a number of firms in this country and in America. The Heyrovský original type of polarograph with a mirror galvanometer of a sensitivity of about 10^{-9}A for photographic recording is distinguished from apparatus in which DC valve amplification of the current enables an ink recorder to be employed. In either case the sensitivity is reducible in ratios down to one-thousandth without appreciably altering the period of the recorder. A certain lag is desirable, since it smooths out the serrations in the curves. To obtain greater accuracy in the measurement of differences of current it is useful to have a counter current and an adjustable zero device.

The polarograph manufactured by the Cambridge Instrument Co., Ltd., has a mirror galvanometer that is adjustable in the way just mentioned; the rotary potentiometer and photographic camera are actuated by a synchronous motor drive, " gas-light " photographic paper is used and voltage and current scales are automatically printed

Fig. 4.—Cambridge electro-polarograph with motor-driven recording camera

thereon. The time required for a complete photographic analysis is about 10 minutes. When desired, direct observation can be resorted to, the voltage being read on a scale attached to the rotary potentiometer and the current on the inclined glass scale visible in front; the potentiometer drum may also be turned by hand.

In America apparatus of the original type is manufactured by E. H. Sargent of Chicago, while the Fisher Scientific Co. of Pittsburgh, Pa., markets a simpler "electro-pode" which dispenses with automatic reading.

An ink recorder in conjunction with a DC valve amplifier is employed by H. Tinsley and Co., Ltd., whose apparatus permits either a fixed or a steadily increasing bias to be applied to the current and the sensitivity of recording to be varied. Damping of the current record can be controlled, or practically dispensed with. In America an ink recording outfit is manufactured by the Leeds and Northrup Co. of Philadelphia, named the "Electro-chemograph" (British agents: Integra Co., Ltd., of Birmingham).

Two types of capillary are in use; cylindrical ones obtainable in foot lengths of a bore of 0·05 to 0·06 mm. and conical ones usually made by the operator from "Pyrex" glass tubing of about 5 to 6 mm. outside diameter and 0·5 to 1 mm. bore. In the latter case after heating the tube to constrict its bore and thicken its walls it is drawn to an outside diameter of about 2 mm.

Mercury droplets should trickle out at the rate of one per 6 to 8 seconds in pure water, or about one droplet per 3 seconds in the test electrolyte. No water or test solution must ever be allowed to enter the capillary, and when not in use the flow of mercury is stopped by a tap or pinch-cock.

Method of Procedure

The substance to be analysed having been weighed and brought into solution, an aliquot part is mixed with a suitable amount of "basic" solution. A convenient composition for this should be determined for every type of test and a stock kept for use. The polarogram having been obtained, two quantities have to be determined for each "wave", the voltage of the inflexion point and the height of the wave. The former serves to identify the electrolytic process, the latter while theoretically proportional to the concentration of the test substance is also governed by numerous other factors, such as size and rate of the drops, etc.

The height of a wave is in practice not usually determined by the 45 deg. tangent potentials before mentioned, but by the method shown by thin lines in fig. 3. Straight lines are drawn through the centres of the serrations in the portions of the polarogram preceding and following the step and also one through its steep part. The intersections of the latter line with the former ones mark the beginning and the end of the step. The point half-way between these two is the inflexion point and determines the half-wave voltage. The height of the wave corresponding to a given concentration of test substance must be found by calibration under rigidly fixed conditions of temperature, size and rate of the droplets dependent on the capillary and height of the reservoir, etc.

It is advisable to plot wave heights against concentrations over the whole range likely to be of interest, for exact proportionality cannot be relied upon. A device frequently employed after making a polarogram is to add to the solution under test an amount of substance equal to that found and re-examine the wave. If all is correct the fresh wave would be double the height of the first, or at least agree with the calibration curve. While numbers of constituents may be determined in one polarogram, the half wave potentials of two successive ones should not differ by much less than 0·2 V, a fact that may often be by-passed by a change of the basic solution. A large wave coming before a small one is a source of difficulty which is best met by employing a suitable counter current during the recording of the small wave. It is frequently useful to apply separations of a purely chemical character before polarographing the solution.

Eliminating Oxygen

Since oxygen dissolved from the air is slowly reduced at a potential dependent on the presence of extraneous substances comprehensively termed "catalysts", it is generally necessary to free the test solution from oxygen by bubbling either hydrogen or nitrogen through it for about 15 minutes. In the case of alkaline test solutions this may be dispensed with, if an addition of sodium sulphite is made to the basic solution. The sensitivity of the polarographic method is stated to be usually about 5×10^{-6} normal, meaning in the case of copper or zinc about $1\frac{1}{2}$, in the case of lead about 5 parts per ten millions of solution.

The most important substances which may be estimated by the polarograph are those that are reduced at a mercury cathode. Besides these a few substances have been determined by their "catalytic" effect on the oxygen wave, and some colloidal and other substances readily adsorbed on mercury by their effect on "maxima". In a few instances such as anions which form sparingly soluble mercurous salts like Cl^-, SO_4^{--}, etc., determinations may be made by the polarograph if the dropping electrode is made the anode instead of the cathode.

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Power-Factor Tests

Determining Average Values for Three-Phase Circuits

By G. W. Stubbings
B.Sc., A.M.I.E.E.

CONSUMPTION tests of three-phase industrial loads usually include the determination of average power factor, which is best deduced from the registrations of integrating instruments. One of the instruments necessary is the kWh meter that measures the principal quantity required and the second is a meter for measuring reactive consumption. From corresponding advances of these two meters three-phase power factor is readily obtained. This method, which requires one additional instrument only, is better than using a special power-factor indicator for the usually unsteady industrial load.

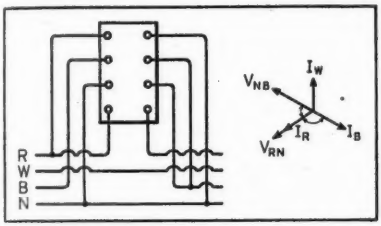


Fig. 1.—Method of connecting standard meter for reactive measurements where neutral of three-phase supply is available

For a three-phase load that is approximately balanced, a three-phase meter can be used, connected either according to the reversed-phase or the crossed-phase schemes. Otherwise a single-phase meter can be used with equal accuracy. If, however, the three-phase load is unbalanced, these methods of measuring reactive consumption are unsuitable, and a method which is accurate irrespective of line-current balance is desirable.

Permanent measurements of the reactive component of an unbalanced supply for accounting purposes are generally made by a meter designed for the purpose. A specia linstrument of this kind will not, as a rule, be available for a consumption test, so that methods of measuring reactive consumption by means of standard meters, such as are normally carried in stock, are of practical interest.

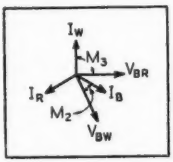


Fig. 3.—Vector diagram of current and voltage associations

The direct measurement of unbalanced reactive consumption can be made by a standard three-wire, three-phase meter which is energised by voltages lagging 90 deg. in phase on those used for energy measurement. The condition for accuracy with this method is that the line voltages are balanced. Where the neutral of a three-phase supply is available a standard meter can be used for reactive measurements when connected as shown in fig. 1. The vector diagram indicates the associations of current and voltage in the meter elements, the instrument registering $1/\sqrt{3}$ times the reactive consumption.

This method has two drawbacks. The meter operates with only about one-half of the rated pressures and is unsuitable for high-voltage consumption tests when the meter voltages are obtained from V-connected transformers and no neutral is available. On the other hand the method is a direct one, and gives reactive consumption by the application of a $\sqrt{3}$ multiplying constant to the meter advance.

As an alternative to this method a standard three-phase meter can be so connected that it gives an advance which, combined with the corresponding advance of the kWh meter, enables the reactive consumption to be obtained indirectly. A connection of this kind is shown in fig. 2; no neutral is required, and the meter voltages have the standard value. The vector diagram shows that these voltages are made to lag 60 deg. on those used for energy measurement. As an energy meter rotates at a speed corresponding to $(VA)\cos\phi$ where (VA) represents total equivalent voltamperes, so a meter connected as shown in fig. 2 will rotate at a speed corresponding to $(VA)\cos(\phi-60°)=\frac{1}{2}(VA)\cos\phi+\frac{\sqrt{3}}{2}(VA)\sin\phi$, or to $\frac{1}{2}P+\frac{\sqrt{3}}{2}Q$, where P and Q represent respectively the power and the reactive VA in the load. Thus, if corresponding advances of

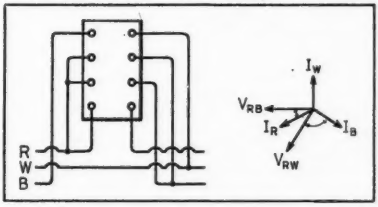


Fig. 2.—Alternative method, without neutral

the kWh meter and the specially connected meter are respectively N_1 and N_2, then $2N_2 = N_1 + \sqrt{3}$ (kVArh) so that the kVArh consumption corresponding to N_1 kWh can be easily calculated.

A three-phase meter carrying not the red and blue currents of the energy meter, but white and blue currents, and energised by line voltages giving the associations shown in the vector diagram of fig. 3, would also rotate at a speed corresponding to $\frac{1}{2}P + \frac{\sqrt{3}}{2}Q$, and the advance of this meter would be exactly as one connected as in fig. 2. This advance would be the same as the sum of the advances of two single-phase meters connected with the current and voltage associations shown in fig. 3.

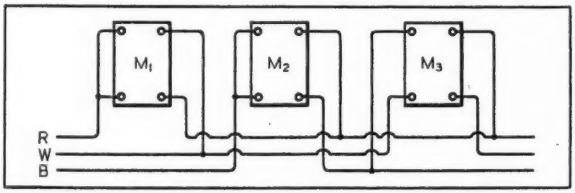


Fig. 4.—Metering arrangement with three single-phase instruments

The single-phase meter carrying blue current is connected in exactly the same way as one of the meters of a single-phase combination, measuring energy, and carrying red and blue currents. It therefore follows that if three single-phase meters are connected as shown in fig. 4, the advances of M_1 and M_2 will give the energy consumption, while the advances of M_2 and M_3 will give the composite consumption $\frac{1}{2}$ (kWh) + $\frac{\sqrt{3}}{2}$(kVArh).

If the advances of M_1, M_2 and M_3 are respectively n_1, n_2 and n_3, then $n_2 + n_3 = \frac{1}{2}$ (kWh) + $\frac{\sqrt{3}}{2}$ (kVArh) and $2n_2 + 2n_3 = n_1 + n_2 + \sqrt{3}$(kVArh), so that (kVArh) = $(n_2 - n_1 + 2n_3)/\sqrt{3}$.

The advantage of the metering arrangement in fig. 4 is that the smallest number of meter elements is used for the measurement of energy and reactive consumptions. Further, and subject to the condition that line voltages are balanced, this method is inherently the most accurate, for single-phase meters can be calibrated with greater precision than two-element, three-phase instruments. On the other hand all three line currents pass into the meter combination, so that, with heavy loads, three substandard current transformers are required for the greatest accuracy. Usually sufficient accuracy in the power-factor determination will be obtained if the current transformer in the white line is of the industrial grade, the substandard transformers being used for the determination of energy consumption in red and blue lines.

The scheme of fig. 4 is capable of an interesting development for consumption tests of three-phase four-wire loads of which the single-phase line-to-neutral loadings are known to be non-inductive and of unity power factor. This corresponds to the usual condition in which all three-phase power is three-wire and all lighting is supplied between lines and neutral. In this condition corresponding energy and reactive consumptions can be accurately measured, irrespective of balance of line currents, by the metering combination shown in fig. 5. The single-phase meters M_1, M_2 and M_3, are connected in the same way as those of the fig. 4 scheme, and from these advances the reactive consumption in the three-wire component of the load can be calculated by the formula given above.

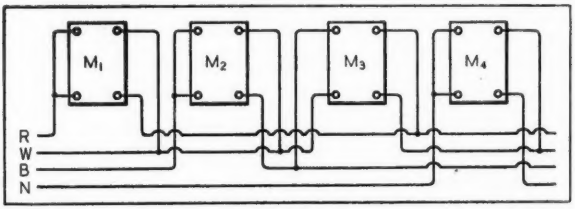


Fig. 5.—Combination of four single-phase meters for measurement of energy and reactive consumptions irrespective of balance of line currents

The three meters M_1, M_2 and M_4 are correctly connected for power integration according to the requirements of Blondle's principle, the white line being treated as the common return conductor instead of the neutral. The sum of the advances of M_1, M_2, M_4 thus gives the total energy consumption in the four-wire load, so that, subject to the conditions of voltage balance and non-inductive line-to-neutral loading, the energy and reactive consumption, and also the average power factor, of an unbalanced three-phase four-wire load can all be deduced from the readings of four single-phase meters.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Intensive Electrical Engineering Course

SOME time ago you were good enough to publish a notice giving the dates of commencement of a full-time intensive course in electrical engineering under the Hankey Scheme. You will be glad to know that, as a consequence, we enrolled some students through the medium of your paper.

I should be grateful if you would kindly once more draw the attention of your readers to the fact that we are starting another course on Monday, October 5th, and that it is desirable that those interested should make application to the Borough Polytechnic, Borough Road, S.E.1, as soon as possible. As you know, these full-time courses last six months, at the end of which the students sit for the Higher National Certificate in Electrical Engineering. Tuition is free and maintenance allowances are paid to students while in attendance at the course.

With many thanks for your valuable assistance.

*Borough Polytechnic, S.E.*1. W. C. S. PHILLIPS, *Head of Department of Electrical Engineering.*

Control of Peaks

YOUR editorial of August 20th is a timely reminder of the importance of "clipping the peak." Many supply authorities appear now to have a double peak, occurring during the morning and in the late afternoon, which makes it more difficult for the consumer to take advantage of an off-peak tariff should it be required to cut off or restrict the load during *both* periods. It might, of course, be possible in certain cases to apply peak control to one class of user, say, during the morning and leave them free in the late afternoon, and *vice versa*.

It has surprised me that so many supply authorities appear to be reluctant to introduce an off-peak tariff to industrial users and as typifying this I recently informed a supply authority that clients of mine were willing to reduce their load of 260 kW in the December quarter and 160 kW in the March quarter to 50 kW during the very extended peak hours of 10 a.m. to 5 p.m. November to February inclusive. This would obviously have the effect of reducing the demand charges for electricity purchased by the authority and it was suggested that such a reduction in purchased cost would permit of a substantial reduction in the charges to my clients.

It was surprising, therefore, that the authority should turn down the suggestion on the score that the amount of load which could be kept off the peak period was not a very considerable portion of the total load and that it was not considered worth while to take any action in the matter. It does seem entirely unreasonable that in this case the consumer should be prevented from making an economy at no expense to the supply authority. The magnitude of the load is not the issue, but the principle of peak control, which you so ably enunciate, is.

This attitude is contrary to that of many supply authorities who give every encouragement to the off-peak load power user by the introduction of an off-peak tariff, and I have no doubt it would be beneficial if such tariffs were more generally introduced.

Barnet, Herts. E. W. DOREY.

Voltage Regulators

REFERRING to Mr. H. M. Lacey's letter in your issue of August 21st, we should like to thank him for pointing out the error in the article under this title in the *Electrical Review* of July 10th.

The section of the article referred to was originally written with the regulation expressed as percentages in the manner customary in transformer calculations. Following a suggestion that it would be preferable to make direct use of ohmic values, it was rewritten and the necessary correction to the denominator of the second term of the formula for the drop at unity power factor was overlooked, and the figure appropriate to a percentage evaluation retained.

The formula for drop at unity power factor should have been written $V = I\left(R + \frac{X^2}{\frac{2E}{I\sqrt{3}}}\right)$ where E is the usual line-to-line voltage of the supply. In the numerical example which follows the denominator then becomes 58.2 instead of 200, but as Mr. Lacey points out, this correction does not materially affect the results in this particular case.

BRITISH ELECTRIC TRANSFORMER CO., LTD.
Hayes, Middlesex.

I.E.E. Devon Sub-Centre

THE new chairman of the Devon and Cornwall Sub-Centre of the Institution of Electrical Engineers (Mr. A. E. Baker) is to deliver his inaugural address at the ordinary general meeting on October 1st at the Royal Clarence Hotel, Exeter.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Association of Scientific Workers has chosen **Mr. J. A. Henley**, B.Sc., A.M.I.E.E., as the first delegate representing organised scientific workers to attend the Trades Union Congress which meets at Blackpool from September 7th to 11th. Mr. Henley, who is at present employed by the Government, received his training in electrical engineering at East London College, and has worked in the U.S.A. and for the Metropolitan-Vickers Co. in this country. He is part author with Professor MacGregor Morris of a book on the cathode-ray oscillograph.

Mr. P. L. Weir, the president of the Electrical Power Engineers' Association, and **Mr. W. Arthur Jones,** the general secretary, are to represent the Association at the Trades Union Congress.

Mr. G. H. Glover, chairman of the Tees-side Section Committee of the E.P.E.A. has been recalled to active service as Lieut.-Commander, R.N., and has been compelled to relinquish his Association activities.

Mr. W. S. Fowlie (not Foley as given in our last issue), who got away from Singapore when it was occupied by the Japanese, writes to tell us that he is now in this country. His address is 75, Alexandra Court, Wembley Park, Middlesex.

Mr. C. Culmer Hodges, who has been nominated for the chairmanship of the Western Centre of the Institution of Electrical Engineers for the ensuing session, is chief engineer and manager of the St. Austell and District Electric Lighting & Power Co., Ltd. He was an articled pupil with the Bournemouth & Poole Electricity Supply Co., Ltd., and subsequently became works electrician. In 1909 he went to Dover Corporation electrcity undertaking, where he was a charge engineer until 1911, when he became engineer and manager of the Dawlish Electric Light & Power Co., Ltd., and a year later took on the additional duties of secretary. He relinquished the post in August, 1930, when he was appointed to his present position. During the last war he served with the R.A.F. in France. He is an associate member of the Institution of Mechanical Engineers.

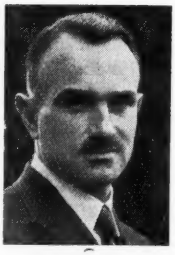
Mr. C. Culmer Hodges

Mr. T. S. Lascelles and **Mr. F. J. Sykes** have been elected directors of the W. R. Sykes Interlocking Signal Co., Ltd. Mr. Lascelles has been appointed managing director, and Mr. Sykes, son of the late managing director, has been appointed engineer to the company.

Mr. W. R. Rawlings has succeeded his brother, the late Mr. J. J. Rawlings, as chairman of the Rawlplug Co., Ltd. **Mr. R. J. Rawlings** has been appointed a director of the company.

Dr. James S. Thomson, President of the University of Saskatchewan, has been recommended for the appointment of general manager of the Canadian Broadcasting Co. **Major Gladstone Murray,** who left the B.B.C. in 1926 to become general manager of the C.B.C., is designated for the post of director-general of broadcasting for Canada.

In our last issue we reported the appointment of **Mr. A. R. Cooper,** A.M.I.E.E., M.Inst.F., as operations engineer for the Central Electricity Board's South-East and East England Area. We now reproduce a portrait of Mr. Cooper.



Mr. A. R. Cooper

Mr. A. Duperron, assistant general manager of the Montreal Tramways Co., has been elected president of the Canadian Transit Association for the ensuing year.

Mr. M. Childs. B.Sc. (Eng.), has been elected chairman of the London Students' Section of the I.E.E., and **Mr. J. D. McNeil**, B.Sc. (Eng.), is vice-chairman.

Obituary

Mr. L. Hermes.—The death occurred recently of Mr. Laurence Hermes who had varied interests in the electrical and radio world. He was born at Marlow in 1884 and after his education at the Marlow Grammar School spent some years with Continental electrical concerns. Upon his return to this country he started an electrical business of his own, being closely associated with Capt. S. R. Mullard. He served in the army during the last war, but was released for special work.

Mr. Hermes was one of the first to realise the potentialities of broadcasting. He became associated with the G.E.C. in Newcastle, during which time the 2LO and 5NO stations were inaugurated ; he was particularly responsible for the construction of the latter (Newcastle) station. Some years afterwards he joined the Marconi Co. as sales manager and served on some of the early radio associations.

Later he was concerned in the introduction of picture telegraphy and talking pictures into this country. At the time of his death he was joint managing director, with his son (Major Laurence W. Hermes) of Transreceivers, Ltd., Surbiton.

Mr. G. Stamp-Taylor, M.C., M.I.E.E., whose death is reported in the *New Zealand Electrical Journal*, was until his retirement last year Australasian manager for A. Reyrolle & Co. He was born in Leeds and studied at Faraday House, after which he joined the staff of the North Eastern Railway, being engaged chiefly on electrification work. In the last war (he also served in the South African campaign) he was attached to the 17th Northumberland Fusiliers

in a technical capacity. He rose to the rank of major and was awarded the Military Cross. In 1919 he became the New Zealand representative of A. Reyrolle & Co. and associated companies and soon established a wide circle of business and personal friends in the Dominion. He left to go to Sydney as the company's Australasian manager in 1927, but returned to New Zealand on his retirement last year and took up residence at Silverstream. He continued to take an active part in electrical affairs, being a member of the Hutt Valley Electric Power Board, and he assisted in the solution of the many problems confronting the Dominion's electrical industry due to war conditions.

Mr. P. L. Halsey.—We regret to learn of the death of Mr. P. L. Halsey which occurred at his home at Hinchley Wood on August 11th. Mr. Halsey was founder and for many years, until his recent retirement, managing director of Halsey's Electrical Co., Ltd., electrical wholesalers. He had been connected with the industry for over fifty years and was known to a wide circle of electrical men.

Mr. J. G. White, whose death at Greenwich, Connecticut, is reported, was formerly head of the engineering and contracting concerns bearing his name. The J. G. White companies have carried out large constructional works all over the world, including power stations, power lines and electric railways. Among these were the Buffalo-Niagara Falls electric railway, one of the earliest of the North American high-speed interurban lines, and in England a number of tramways, including those at Bexley and Dartford.

Will.—The late **Mr. E. Hesketh,** a former chairman of J. & E. Hall, Ltd., left estate of the gross value of £48,704 (net personalty £47,996).

Eliminating Power Wastage

The Value of Foot-Switch Control

By D. T. Naylor

IT is generally appreciated that there is considerable wastage of electric power on machine tools in any factory, due to operators leaving their machines running while not actually using them. To eliminate this completely is practically impossible, as in the majority of cases there is no option but to rely on the individual operators to use the power on their machines on the most economical manner. Constant reminders by planned publicity campaigns and strict supervision help considerably, but there is always that human failing of forgetting to switch off when leaving the machine for a short period.

There is also the class of machine extensively used in tool rooms which has no specific operator but is for general use by all, and this warrants special attention. Machines of this class, notably hand-operated grinders, are undoubtedly more than any others left running after use. With a view to eliminating this wastage, foot-switch control of a typical machine has been tried and the following test readings, which speak for themselves, were obtained:—

Tests on a 3-HP Rowland single-stone grinder for general use in a tool-grinding department showed a seven-day consumption of 16.5 kWh when the machine was fitted with a standard direct-on-line starter connected to hand-operated " start " and " stop " push buttons. When the machine was fitted with standard direct-on-line starter connected to foot-operated spring-return switch, the consumption for seven days was 3.87 kWh, showing a reduction in power consumed of 12.93 kWh, or a saving of 77 per cent.

The machine would start and run only when the foot switch was depressed, stopping immediately on its being released. The switch was a heavy type, not fixed to the floor, but connected to the machine proper by flexible tubing. The purpose of this arrangement was to enable operators to slide the switch to the most convenient position.

Although the proportion of machines in any one factory which are suitable for this type of control may be small, the saving in power per machine certainly appears great enough to warrant earnest consideration being given to the fitting of foot switches by all concerned with industrial fuel saving.

American Electrical Terms

AFTER twelve years' work by over 300 engineering experts and 34 representative bodies, definitions of the important terms common to all branches of the electrical art as well as those terms that are specifically related to each of the various branches have for the first time been assembled in a single book. This U.S. Standard C42/1941, of 311 pages, which has also been approved by the Canadian Engineering Standards Association, originated in 1910 when the International Electrotechnical Commission commenced the classification of recognised systems of nomenclature. In 1927 the U.S. National Committee of the I.E.C. began organising an American vocabulary as a supplement to the proposed international list. It is claimed to cover three times the field of any similar publication in other languages, being divided into 18 distinct major groupings, each of which is subdivided. Thorough indexing makes the new book an easy source of reference ; its sponsor and publisher is the American Institute of Electrical Engineers, 33, West 39th Street, New York, N.Y., U.S.A., the price being $1.25.

COMMERCE and INDUSTRY

Heating Equipment Control. Lighting Propaganda.

Limitation of Heating Apparatus

THE Limitation of Supplies (Heating Apparatus and Polishes) (No. 3) Order (S.R. & O. 1942, No. 1511) is now available (Stationery Office, price 1d.). As has already been announced this Order allows the same rate of supply during the four months August to November, 1942, as was allowed during June and July. Thus, during the four months, electric and gas space-heating apparatus may be supplied to the extent of 16⅔ per cent. by value of the sales during the six months ended November 30th, 1939.

The only space-heating appliances controlled are types using gas or electricity, but manufacturers are reminded that the manufacture and supply of electric space-heating apparatus is subject to licence under the Electrical Appliances (Control of Manufacture and Supply) Order, 1942 (S.R. & O. 1942, No. 1453).

Two amendments have been made in the Third Schedule of this Order. (1) Heating apparatus may be supplied without restriction to hospitals belonging to local authorities (as well as voluntary hospitals and hospitals entered in the Hospitals Year Book, 1941) but may not be supplied to other departments of local authorities. (2) Ships stores dealers have been taken out of the Third Schedule entirely but unrestricted supply is allowed during the restriction period to the Merchant Navy Supply Association, Ltd.

Retail Business Premises

The Location of Retail Businesses Order' 1942 (S.R. & O. 1619) referred to in the *Electrical Review* of August 21st (p. 244), is now available. This revokes the 1941 Order of similar title but is the same in its general terms. It stipulates that no retail business in certain specified classes of goods and services shall be carried on at any premises without licence unless it was being carried on at any time between December 31st, 1940, and October 23rd, 1941. One object is to prevent dealings in fictitious "goodwill." As in the earlier Order, the scheduled goods include radio goods, gramophones and accessories ; electric torches and batteries therefor ; and electrical goods and appliances other than those in the two foregoing classes.

Licences granted under the 1941 Order remain in force and the Order does not prohibit the carrying on at any time of any business which was being carried on on August 20th, 1942, in conformity with the earlier Order.

Licences will be issued by Local Price Regulation Committees, a list of which is given in an appendix to the Order. They will be granted only when applicants can prove that the goods and services which they propose to supply or perform are reasonably required to provide for the essential needs of the public in the area concerned. Special consideration will be given to persons who have lost the use of their premises through war damage or requisitioning by a Government Department.

Lamp Publicity

Two new Ensign lamp showcards are available which, though comparatively small, have a vigorous and attention-compelling design. In addition ENSIGN LAMPS, LTD., are able to offer two attractive window centrepieces and a series of effective cutouts ; also pelmets, leaflets and "dummies." Advertising is being arranged in a large number of commercial and technical publications, as well as the leading newspapers covering distribution centres throughout the country.

The "Mazda" lamp publicity of the BRITISH THOMSON-HOUSTON CO., in addition to advertisements in the national, provincial and trade Press and many of the best known magazines, includes also a small cardboard cut-out and a linen window display. The cut-out is of a topical character and links up with the Government's fuel economy campaign. It is an ingenious piece designed to come within the limit of 100 sq. in., the maximum dimensions allowed. The window display piece, measuring 36 in. by 24 in., is another pictorial reminder to save electricity. It is produced on linen in six colours by silk screen process. Due to the need for economy a limited supply only of this display is available. In addition to the above, large painted road signs placed in prominent positions on many of the main arterial roads leading out

Display piece shown as part of a complete "Mazda" window display

of London, draw attention to " Mazda " lamps. Lighting propaganda will be carried out, as usual, on a large scale in the engineering and industrial Press and " B.T.H. Light-Conditioning for Increased Production and Welfare " will again be the main theme.

In the interests of national economy this season's publicity scheme of SIEMENS ELECTRIC LAMPS & SUPPLIES LTD., is of necessity curtailed. Subject to space limitations, display advertisements will, however, appear from time to time in the national daily Press in order to keep Siemens lamps in the mind of the public and at the same time to link up with the Ministry of Fuel economy propaganda. In view of the urgent necessity for speeding up output from factories of all types special attention will be devoted to improved lighting in factories with Siemens lamps and lighting equipment, and to this end display advertisements will appear in the principal trade journals, which will stress the fact that better lighting does not necessarily mean increased fuel consumption. The company is not making a general distribution of display material, but it hopes that traders will display showcards, etc., already in their possession from previous distributions. Price lists will be available for the trade on request.

Shipyard Maintenance Electricians' Wages

Under a recent agreement between the Shipbuilding Employers' Federation and the Electrical Trades Union, skilled electricians in shipbuilding and repairing establishments, employed exclusively on the maintenance of firms' electrical plant, are to be paid for all hours worked an allowance of 2d. per hour above the national uniform new work plain time rate for skilled electricians.

Bonus for Miners

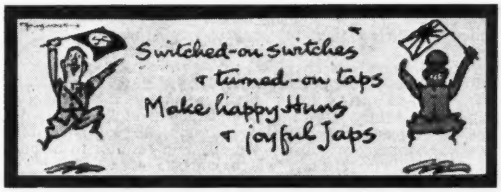
In order to encourage miners to improve output in the face of the urgent demand for coal, the Government has accepted a proposal for an output bonus of 3d. per shift per man for each complete 1 per cent. increase upon the standard output up to a limit of 3s. 9d. a shift for a 15 per cent. increase.

Non-Industrial Fuel Forms

Special fuel assessment forms are being circulated to non-industrial establishments all over the country by the Local Fuel Overseers. Generally speaking, the term " non-industrial establishments " may be defined as premises which are not used wholly or mainly for private residential or industrial purposes or which are not occupied by the Crown or Government Departments. They include such establishments as blocks of flats where any common services are provided by the management ; hotels, lodging houses, boarding houses, residential clubs and public assistance institutions ; restaurants, canteens and refreshment rooms ; schools and colleges ; offices and business premises ; shops, warehouses and public markets ; cinemas, concert rooms and dance halls (but not theatres and music halls) ; museums, libraries and art galleries ; churches, chapels, etc. ; police stations, public baths and wash-houses ; and civil defence premises. Farmers are not concerned with this form.

Fuel Economy

What is described as " Battle Order No. 1 " has been circulated to the managements of electricity and gas undertakings by the Ministry of Fuel and Power. This urges upon them the importance of assisting the public to read their meters so that they can keep an eye on their consumption.



The well-known artist, "Fougasse," designed this fuel economy slip for sticking on correspondence

Concurrently with this the Ministry published in the national Press its second " Battle for Fuel " advertisement which appeals to consumers to read their meters weekly. The " fuel units " which houses of various sizes and in the three " zones " are allotted are set out in tabular form.

The gummed slip illustrated, designed by the well-known artist " Fougasse," is being used by gas and electricity undertakings on correspondence, account forms, etc. Consumers can also have copies to stick up as reminders over cookers, water heaters and other household apparatus.

Radio Valve " Samples "

At Liverpool, on August 28th, Frank Paul Freeman, trading as Super Radio, Ltd., Whitechapel, Liverpool, was fined £100 and ordered to pay fifteen guineas costs for making a false declaration in respect of radio valves. It was stated that Freeman wrote two letters (which were intercepted) to his brother in America suggesting that radio valves should be sent to him declared as samples. It was alleged that these valves were, in fact, used for trading purposes. The defence was that at the time Freeman was under the impression that the valves would be used as samples.

Science and the War Effort

Great interest has been aroused among scientific workers by recent discussions on the utilisation of science to the best advantage in the war effort, and by the reports of the activity of the Parliamentary and Scientific Committee. A motion tabled by twenty M.P.'s to be considered when Parliament reassembles urges the setting up of a central scientific and technical board to co-ordinate war resources and developments. To give scientific workers an opportunity of hearing an exposition of the ideas behind this motion, and to let them express an opinion on it, the Association of Scientific Workers has

arranged a public meeting at the Caxton Hall for 7 p.m. this evening (September 4th). The principal speaker will be Lord Strabolgi.

E.T.U. Gift to Russia

The August *Electrical Trades Journal* gives exterior and interior views of a motor X-ray unit which the Electrical Trades Union has presented through the British National Council of Labour "Help for Russia" Fund. It is a handsome, well-equipped vehicle.

Post-war Design

The Design and Industries Association was formed in 1915 to induce manufacturers to redesign their products to compete in post-war export trade. To-day there is again the need for its stimulus to prepare industry to produce the finest design for commodities which will be used in reconstruction. Consequently an exhibition entitled "Design Round the Clock" has been arranged by the Association to show how everything used during the day is a result of design. The display, which consists of a series of photographs (which can be readily changed to bring the subject up to date) is at present on view at the Geffrye Museum, Kingsland Road, London, E.2. Later it will go on tour.

Throughout the exhibition the importance of electricity in the world of the future is emphasised, some of the aspects covered being the importance of good and appropriately located lighting, contrasts in old and new methods of travel, communal feeding, the development of the telephone and radio apparatus, features to be aimed at in the future design of domestic appliances, and the employment of illumination effects in theatres, cinemas, etc. Particularly with regard to domestic apparatus the conclusion is reached that objects of purely functional purpose tend further towards simplicity with development.

Fatalities

William Hallam (43) a labourer at a works at Derby, recently received a fatal electric shock when he touched a bare live wire. At the inquest last week Albert Shardlow said that he and Hallam decided to move a machine nearer to a heap of sand which they were shovelling. Hallam assured him that he had switched off the current, but when they attempted to move the machine both of them received a shock. Other evidence showed that the 200-V cable had become detached from the plug base and was catching on a metal frame. Neither the cable nor plug was periodically examined. According to a factory inspector the earthing of the apparatus was inefficient. The inquest was adjourned to enable the company concerned to call evidence in rebuttal of the suggestion that they had failed to comply with the factory regulations.

While engaged in tracing an electrical fault at an Audenshaw works an apprentice electrician received a fatal shock.

The R.E.M.E.

Although the new Corps of Royal Electrical and Mechanical Engineers is not to be formally constituted until October 1st the necessary organisation has reached an advanced stage. The Corps is an outcome of a recommendation of the Beveridge Committee on the Use of Skilled Men in the Forces, and it will comprise men transferred from the R.A.O.C., the R.A.S.C. and the R.E. It will take over the Army's maintenance services, and an R.A.S.C. officer, Major-General E. B. Lowcroft, has been appointed Director of Mechanical Maintenance.

Specialist courses are being arranged, including electrical and welding courses, and qualified tradesmen in the ranks will be known as "Craftsmen."

The badge of the Corps comprises four shields, each bearing one of the Corps' initials within a pair of calipers, the whole being contained within a laurel wreath surmounted by a crown.

A.E.U. to Admit Women

By a ballot the membership of the Amalgamated Engineering Union has agreed to the alteration of the Union's rules, enabling women to be admitted as members.

Palestine Import Restrictions

The *Palestine Gazette* of July 26th contained a copy of a Government notice which provides for restrictions on the importation of certain goods into Palestine. According to the *Board of Trade Journal* the commodities which are being imported on Government account or through a sole importer and in respect of which no import licences will be issued to private importers include generators, motors, convertors, transformers, electric accumulators, other than batteries for motor vehicles, insulated cables and electric wire.

Among the commodities, the importation of which from overseas is prohibited except from Trans-Jordan, Egypt, Sudan, Arabia, Iraq, Iran, Turkey, Syria, Cyprus, Aden, Kenya, Uganda, and other East African Dependencies, are electric dry batteries, electric accumulators for motor vehicles, washing machines, as well as small household appliances. Electrical machinery and apparatus, the importation of which is permitted within quota limits includes electrical machinery, other electrical apparatus and appliances not elsewhere listed, refrigerator parts, electricity meters of all kinds, radio sets and parts, telephone and telegraphic apparatus, and scientific instruments.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

M.-S. miniature toggle switch.

Dellread Gears (Holdings) Co., Ltd., (last known address 2, St. Anne's Lane, S.W.1.)

War Damage

Some Features of the New Amendment Act

By F. E. Sugden, A.C.I.S.,
Barrister-at-Law

ATTENTION should be drawn to the changes proposed by the War Damage (Amendment) Act, but I think it necessary to deal only with those changes which directly affect the trader, because some of them are purely administrative changes.

The Act provides for the continuation of the War Damage Act, 1941, until August 31st, 1942, and thereafter that Act is to be terminated by an Order made by the Treasury and approved by Parliament. It also determines when instalments are due in reference to the insurance of property. Before the passing of the Act, false claims were being made under the War Damage Act; a clause in the new Act provides that if any person, for the purpose of obtaining payment in respect of damage under the Act or under a policy of insurance under Part II of the War Risks Insurance Act, or under a policy issued in pursuance of the Commodity Insurance Scheme, furnishes any information which he knows to be false in material particulars, or recklessly furnishes any information which is false with an intention to deceive, he is liable to penalties. Further, if a claimant, or a person acting on his behalf, produces or makes use of books or accounts which are false or withholds any material information, the guilty person is liable to a penalty of £100 or imprisonment for three months or both.

In the past only those persons who were insured under the War Risks Insurance Act were eligible for the benefit given under the Act, but now the Treasury has the power to make special exceptions to this rule where the trader has had his goods destroyed by enemy action.

Temporary Works

The First Schedule deals with the question of the cost of temporary works, that is repairs to premises of a more or less temporary nature. In such cases money can be deducted from the ultimate cost of repairs to those premises. Suppose it is necessary to carry out an electrical installation and through no fault of the electrical contractor, but because no other goods are available owing to war conditions, the work is inferior in quality, the cost of the work will be deducted from the claim for damages. Therefore the contractor is strongly advised to warn his client before executing the work, otherwise he might lay himself open for action for breach of contract, for putting in inferior goods.

The Act lays down that where the cost of repairs exceeds the value of the property only the value of the premises will be paid. Therefore an electrical contractor should be careful before he executes the repairs to make sure that he will be paid for them.

Where the property is compulsorily requisitioned for road improvement purposes or clearance schemes, then only compensation for the loss actually sustained by the trader will be paid and not necessarily the loss which the property has sustained. If all the repairs are to be carried out then the acquisition of the premises will be taken into consideration in assessing the compensation.

The electrical contractor should ascertain whether a house is deemed to be unfit for habitation or not before he undertakes any work on the premises. The Act lays down that in deciding whether the property is unfit or fit for any purpose, regard should be had to any relevant circumstances, namely, for what purposes the occupier of the premises uses the property concerned and also the standard of the accommodation available in the same locality for a similar purpose.

Short Tenancies Defined

There has been a great controversy as to the kind of property this Act is applicable to and also as to what extent the War Damage (Amendment) Act which deals with short tenancies applies. This Act states that the term short tenancy includes (a) tenants at will (b) tenancies granted for a term limited to expire, or subject to the right of the landlord to determine, at any time within a period expiring not later than seven years after the termination of the war.

The Second Schedule of the Act deals with the legal position of mortgagors and mortgagees under the War Damage Act, 1941. In this Act provision was made for the recovery of portions of the contribution from mortgagees. It was assumed that there was only one mortgage, but frequently there is a second or subsequent mortgage. In the new Act it is laid down that the ratio of the value of the property to the value of the mortgage shall be considered in ascertaining the deduction which the occupier is entitled to from the mortgagee. Frequently the mortgage is not on the whole building but only on a floor or storey, etc., the remaining part being covered by another mortgage. To avoid confusion that particular floor or storey is to be treated as a self-contained mortgage and the ordinary

rule regarding the recovery of payment can apply under the 1941 Act.

In the Third Schedule provision is made whereby the Board of Trade, if it is satisfied that it is expedient to do so to avoid hardship, may make early payments under the Private Chattels Scheme ; this also applies to the Business Scheme. New powers and new conditions are created to allow half or full payment to be made at an early date for goods destroyed or damaged. It is allowable under the provisions of the 1941 Act if the Board of Trade is satisfied that the replacement of goods is expedient in the public interest. It is implied that the money shall be used to replace or repair any goods specified by the Board of Trade. If the conditions are not complied with the Board can recover the money.

The Board of Trade will have the power to make payment in respect of war damage under the Business Scheme, though the goods were not previously insured.

NEW BOOKS

Production Equipment Manual. Uses of the Spectroscope.

The Machine Shop Yearbook and Production Engineers' Manual. Editor: H. C. Town. Pp. 559; figs. 412. Paul Elek, Ltd., 39, Parker Street, London, W.C.2. Price 25s.

At the price this book is not likely to attract the average mechanic, but it should find its way into the hands of foremen, supervisors, and maintenance engineers, providing a guide to the construction and operation of modern machine tools, including many of the latest types from the United States. A chapter dealing briefly with the application of electric control gear to machine tools is more a matter for the production engineer, but electrical men will be interested in a chapter on electrical equipment, with an excellent treatment of the commutator motor now available with the characteristics of the DC machine. The busbar system is mentioned and information is given on elementary testing. The chapters on individual types of machine tools also refer to the electrical equipment, including Ward Leonard control and the electro-hydraulic control developed extensively on American machines.

Rather more could with advantage have been said about the electrical side considering that most machines to-day are self-contained. The subject of maintenance has not been covered, a most important point in view of the causes of breakdown due to the damaging effects of oil, coolant and abrasive materials. In view of the increasing use of electric furnaces for heat treatment of parts between different operations and the finished product a chapter on this subject would be of interest to many. Workshop equipment is well covered as also are testing and measuring, and welding and brazing.

The volume can be recommended, as the processes described are the latest examples of British and American practice; furthermore there is a considerable amount of specialised information of value to the engineer who is interested in post-war production.—H. G.

Spectroscopy and Combustion Theory. By A. G. Gaydon. Pp. 191; figs. 9. Chapman & Hall, Ltd., 11, Henrietta Street, London, W.C.2. Price 17s. 6d.

The early use of the spectroscope revealed the simple constituents of flames and some of the reactions which took place within them. More detailed examination of the emitted spectra showed the presence of such radicals as OH, CH, NH as part-products of the combustion process. These are physically stable but chemically unstable, and give an indication of the complexity of the reactions involved.

Although most of the early work was, perforce, carried out on the visible and near ultra-violet regions of the spectrum, later work showed how important was the infra-red region, because of its large energy content and its close relation with the after-burning effects.

Scientists who wish to know what part the spectroscope has played in combustion theory will find in Dr. Gaydon's monograph a very readable and stimulating book. In it he discusses the direction in which advances have been made, as well as the trend of developments, with a directness and simplicity characteristic of an expert investigator, who has contributed original work in important parts of the field.

The chapter on " explosion spectra " gives just one instance of how useful the spectroscope has been in resolving problems in other fields—in this case, " knock " in internal combustion engines. Examination of the abnormal spectra distinguishes the case of the " knocking " engine by its association with rapid burning of the last part of the charge. The introduction of lead-tetraethyl prevents this happening, and produces the normal spectra.

The book is so arranged that chapters are practically self-contained and are thus invaluable for reference. These deal with hydrogen, carbon monoxide and hydrocarbon flames, as well as absorption spectra, infra-red region, lifetime of activated molecules; after-burning of CO; and thermodynamical considerations. Appendices are arranged as reference tables of band systems of organic and other flames; absorption spectra, atomic and molecular energy levels, and there is a good bibliography and index.—L. J.

Shorter Notices

Electricity in Aircraft. By W. E. Crook. Second edition. Pp. 104 ; figs. 133. Sir Isaac Pitman & Sons, Ltd., 39, Parker Street, London, W.C.2. Price 5s.

Although no major changes have been made in this edition, a new section on the carbon-pile voltage regulator makes the treatment of voltage-control devices more complete.

Introduction to Valves, including reference to Cathode Ray Tubes.—By F. E. Henderson. Pp. 112; figs. 120. *Wireless World*, Dorset House, Stamford Street, London, S.E.1 (on behalf of the General Electric Co., Ltd.). Price, 4s. 6d.

ELECTRICITY SUPPLY

Bangor Aids Consumers. Restrictions in New Zealand.

Bangor.—CALCULATING FUEL TARGET.—Mr. F. O. Harber, the borough electrical engineer, has sent us a copy of a table which is being distributed to the undertaking's consumers showing the amount of electricity that can be used in a year under the domestic fuel target scale. The total fuel units for 1-7 rooms with 1-7 persons are shown, together with the equivalent kWh where electricity is used for all purposes or, alternatively, if 50 cwt. of coal or coke is used.

Croydon.—CHANGING TO FLAT RATES.—The effect of shop window lighting restrictions on consumers who take their supply on the "all in" business tariff, which includes a standing charge based on the amount of lighting installed, was recently considered by the Electricity Committee. It was decided to inform consumers desiring to change to the flat rates that in present circumstances such a change may be made immediately after the last meter reading before receipt of notice. The current flat rates per kWh are 5d. for lighting and 1½d. for heating, plus 10 per cent. war additions.

Derby and Notts.—LOWER MINIMUM CHARGE. — The Derbyshire and Nottinghamshire Electric Power Co. announces that the quarterly minimum charges, which vary between 6s. 8d. and 12s. 6d., have, as a temporary wartime measure, been reduced to 5s.

Northern Ireland.—The Northern Ireland Parliament has accepted the amendments to the Electricity (Emergency Supplies) Bill made by the Senate.

BELFAST REORGANISATION. — A sub-committe of Belfast Corporation recently considered the reorganisation recommendations made by Mr. W. M'C. Girvan, city electrical engineer. The recommendations will involve a series of staff promotions.

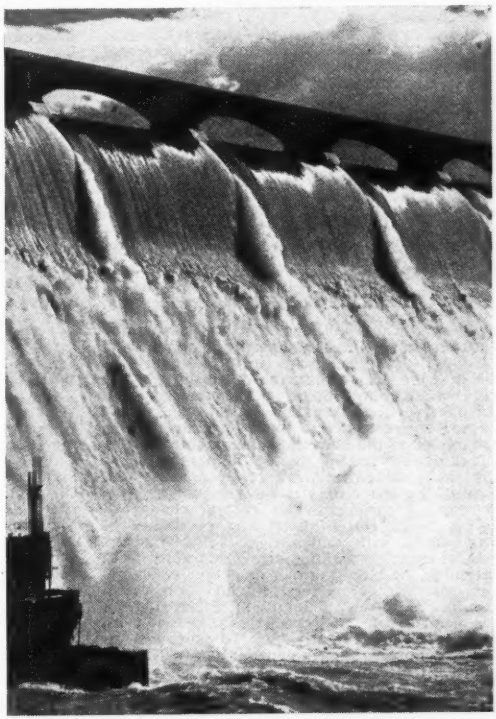
West Hartlepool.—LOAN.—The Corporation has decided to apply to the Electricity Commissioners for sanction to borrow £686 for sub-station equipment.

Overseas

France.—ELECTRICITY RATION REDUCED.—Another reduction in the electricity ration has been enforced. All business offices have had to halve their electricity consumption for August compared with the corresponding month last year and supplies to restaurants have been cut by 30 per cent., but domestic consumption has not been reduced. Rainfall has been so small that the level of the artificial lakes and the rivers driving the generators at Massif Central is dangerously low.

New Zealand.—SPACE-HEATING RESTRICTIONS. —In a recent joint statement the Ministers of Supply and Works pointed out that the position with regard to the supply of electricity from the Government system in the North Island had become critical; the fuel plants, as well as the hydro-electric stations, were fully loaded at peak times. Unless the demand was controlled it would be impossible to cope with the load and severe rationing would have to be imposed during critical periods.

The *New Zealand Electrical Journal* reports that to deal with the situation an order has been made banning the use of electric radiators or other space-heating equipment in shops, offices, factories, warehouses, halls, theatres,



This Bureau of Reclamation picture, reproduced from the *Electrical World*, shows the Grand Coulee Dam overflow. This plant now has an installed capacity of 324,000 kW which it is expected to raise to 1,122,000 kW by 1944 or 1945.

etc., in the North Island between 4 p.m. and 6 p.m. during the months of May, June, July and August (except Sundays) in any year. Householders have been asked to take similar action voluntarily. Provision is made in the Order for inspection of premises to ensure compliance with the Order, and if the requirements are disregarded, authority is given for disconnection or sealing-up of all heating points in the premises, if thought fit.

It is admitted that the Order must involve some inconvenience to consumers, but the Ministers declare that the steps taken are necessary to avoid the definite hardships which would be caused if the supply failed altogether through overload.

MILKING MACHINE CONTROL.—Under a recent Order the sale and purchase of new or second-hand milking machines and parts (except those exclusively for renewals and replacements) is prohibited save with the prior permission in writing of an inspector under the Dairy Act, 1908. According to a return prepared by the Statistical Section of the Department of Agriculture the number of milking plants in use at January 31st, 1941, was 30,878, the proportion of cows machine-milked being 86 per cent.

INCREASED CONSUMPTION.—During the year ended March 31st last the main Government substations supplied a total of 1,578.8 million kWh, an increase of 6.3 per cent. over the previous year.

PROGRESS IN AUCKLAND.—The latest annual report of the Auckland Electric Power Board shows that the cost per kWh sold decreased from 0.784d. to 0.724d. and revenue from 0.875d. to 0.795d. Sales totalled 270 million kWh against 253 million kWh in the previous year and the number of consumers rose from 67,435 to 69,571. Electric ranges in use increased from 19,538 to 21,530, and water heaters from 23,764 to 26,315.

TRANSPORT

Spain.—RAILWAY ELECTRIFICATION.—Following prolonged investigations by a commission proposals have been made for the electrification of 1,864 miles of railway. According to the *Railway Gazette*, Spain is particularly well adapted to electric traction for not only is there the incentive to reduce coal imports, but the character of the country is favourable to such working by reason of the numerous heavy gradients. Moreover, the heavy losses in material caused by the civil war have made the time opportune to consider a general change of system. In certain cities the possibility of connecting with underground railway routes makes electrical working highly desirable, if not essential, and the various irrigation reservoirs in existence or planned should form useful sources of power. Señor R. M. Serret y Miret, a member of the National Commission on Electrification, recently pointed out that at present only 783 miles of route (about 7.5 per cent. of the whole railway system of the country) is operated electrically. Although doubts about the economic possibilities of electrification are constantly expressed, the change has paid for itself wherever it has been effected. Spain possesses both coal and water power, but at present has to import large quantities of coal. One of the important things is the need for economising copper, of which at present there is actually a temporary lack, despite the large indigenous production. It is a question, therefore, whether future electrification should not be on the 3,000-V DC system, instead of the 1,500-V system used hitherto. Señor Serret y Miret considers that the first stage of electrification should cover a total of 2,404 track miles over a period of ten years. The whole capital cost of this stage of the programme is put at 932 million pesetas. At the conclusion of the first stage, a second should be embarked on covering a rather larger track mileage. Such a conversion is calculated to effect a yearly saving in imported coal of 1,800,000 tons, leaving 200,000 tons still to be imported.

N.W. England Scheme Amended

THE Central Electricity Board has received from the Electricity Commissioners a further Amending Scheme for North-West England and North Wales. Under the existing Schemes for the area, adopted in 1928 and 1939, the Buccleugh station of Barrow Corporation was to be operated under temporary arrangements with the Central Board and Barrow was to be connected to the grid by a secondary transmission line from Kendal or Staveley to a secondary substation at Barrow. The Amending Scheme gives effect to representations from the Board to the Commissioners to the effect that a review of the present and prospective electricity requirements of Barrow had shown the expediency for the connection to the grid to be by a 132-kV line from the existing main transmission line between Lancaster, Kendal and Carlisle, with a primary substation at Barrow, and for the Buccleugh station to be operated as a selected station.

Copies of this North West England and North Wales (Alteration and Extension) Scheme, 1942, together with an explanatory memorandum by the Commissioners, are on sale at the Stationery Office.

Women's Engineering Society

ARRANGEMENTS for the annual conference of the Women's Engineering Society to-day and to-morrow include an informal dinner to be held at the Forum Club, Hyde Park Corner, this evening under the chairmanship of Miss Caroline Haslett, C.B.E., honorary secretary of the Society, and the chief speakers will be :—Mr. G. H. Ince, C.B., deputy secretary, Ministry of Labour and National Service, Director General of Man-Power ; Mrs. F. G. Miles, director of Phillips & Powis Aircraft, Ltd., organiser of wartime training of women in draughtsmanship ; Mr. F. G. Miles, director of Phillips & Powis Aircraft, Ltd., aircraft designer ; and Miss G. L. Entwisle, A.M.I.E.E., president of the Society. To-morrow a visit has been arranged to a Government Training Centre.

Institute of Physics

The Institute of Physics is arranging a discussion on "Equilibrium Diagrams" at the Royal Institution, 31, Albemarle Street, London, W.1, on September 22nd. Admission will be by notification to the secretary before September 15th.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The Engineering & Lighting Equipment Co., Ltd., held its annual meeting on August 27th. The chairman, Mr. S. A. Marples, said that the company's factory had been fully employed and they had engaged many women workers who had attained a high degree of efficiency. A joint production consultative and advisory committee, with equal representation of management and workers had proved of considerable value. The industrial and street lighting section continued to hold its position in both the home and export markets. Orders had been fulfilled for street lighting overseas.

The Electric Furnace Co., Ltd., reports a net profit for the year ended March 31st last of £55,061 against £47,662 in the previous year. Provision for taxation takes £28,000 (£31,000) and £10,991 (nil) is transferred to general reserve. The dividend on the 7 per cent. cumulative preferred ordinary and ordinary shares is maintained at 8 per cent., to which it was raised last year, and the carry-forward (subject to directors' remuneration) is £6,681 (against £6,961).

The Oriental Telephone & Electric Co., Ltd.—Speaking at the annual general meeting last week Sir A. Henry McMahon, chairman, mentioned that the company had sold all its shares in its three Indian companies for £1,495,036. The book value of the shares, which, of course, had been considerably written down, was £480,000. Thus a surplus of £1,015,036 had been realised which had been added to capital reserves. Their property in Singapore and the properties of the Hong Kong and Rangoon Telephone Companies were in enemy hands, the Rangoon telephone exchange having been demolished under the orders of the military. They were ignorant as to the fate of their property in Singapore and as to that of the Hong Kong Telephone Co., but they had just heard that the Central Exchange Bureau in Singapore had been severely damaged by a bomb. These events had had their effect on the profits for 1941.

The Victoria Falls & Transvaal Power Co., Ltd., reports a revenue of £1,990,171 for 1941, after providing for pension schemes and African taxation, against £2,193,334 for 1940. After adding interest received and meeting administration expenses, depreciation, renewals and taxation there was a net profit of £570,126 (against £583,065). The transfer to reserve is again £150,000 and the dividends on the preference and ordinary stocks are maintained at 10 and 15 per cent. respectively, leaving £342,518 (against £312,004) to be carried forward. Power sales showed a satisfactory increase which is being continued, though not at the same rate. The smaller net profit is due to larger taxation and rebates allowed to consumers.

The Kalgoorlie Electric Tramways, Ltd., reports a revenue of £31,616 (Australian) for 1941. After meeting Kalgoorlie expenses and depreciation there is a balance of £A4,720 equivalent to £3,776 sterling. To this are added interest and transfer fees (£307) and London expenses, debenture service and income tax are met.

Metal Industries, Ltd., which has interests in the British Oxygen Co., Electrical Switchgear & Associated Manufacturers, the Igranic Electric Co., etc., reports a rise in net earnings from £162,375 in 1940–41 to £179,684 last year. Taxation is higher at £85,678. The dividends on the "A" and "B" ordinary stock are maintained at 5 per cent.

The British Oxygen Co., Ltd., is maintaining its interim dividend at 7 per cent.

The British Power & Light Corporation, Ltd., has declared an interim dividend of 2 per cent., as last year.

The Lancashire Electric Light & Power Co., Ltd., has again declared an interim dividend of 7½ per cent.

Walsall Conduits, Ltd., is again paying an interim dividend of 20 per cent. on its ordinary shares.

Telephone Rentals, Ltd., announce a final dividend of 6 per cent. making 10 per cent. (same) for the year.

Brown Bros., Ltd., are paying an interim ordinary dividend of 2½ per cent. (same).

The Carrier Engineering Co., Ltd., is to pay a first and final dividend of 25 per cent. (same).

Erith & Co., Ltd., are maintaining their interim dividend at 5 per cent.

New Companies

Transformer Service Co., Ltd.—Private company. Registered August 14th. Capital, £100. Objects: To carry on the business of manufacturers of, and dealers in, transformers, convertors, condensers, voltmeters, armatures, batteries, magnetos, insulators, wireless and electrical components and accessories, etc. Directors: H. A. Riche, 128, Street Lane, Leeds, and Mrs. H. Brown, 261, Harrogate Road, Leeds. Registered office: 44, Back Francis Street, Leeds.

Burtec Products Co., Ltd.—Private company. Registered August 21st. Capital, £500. Objects: To carry on the business of electrical, radio and general engineers and contractors, wire makers, vulcanisers, dealers in gramophones, batteries, valves armatures and insulating materials, etc. Directors: Dorothy M. Moore, The Oaks, Burwash Common, Sussex; R. L. Davenport, 81, Springfield Avenue, S.W.19; S. J. Smith, Melrose, Burwash Weald, Sussex and J. C. Smith, Weland, Burwash Weald, Sussex. Registered office: 1, Birkdale Avenue, Pinner, Middlesex.

Bintcliffe Turner, Ltd.—Private company. Registered August 15th. Capital, £1,000. Objects: To carry on the business of tool makers, engineers, manufacturers of, and

dealers in, electrical, galvanic, magnetic and other apparatus, optical and scientific instruments, etc. Directors : E. D. Bintcliffe, Wellmead, Oak Lane, Sevenoaks, Kent and V. J. Turner, Worth Cottage, Cross Keys, Ashgrove Road, Sevenoaks, Kent. Registered office : 9a, London Road, Sevenoaks, Kent.

Fulham Electrical Components, Ltd.—Private company. Registered August 15th. Capital, £1,000. Objects : To carry on the business of manufacturers of, wireless components and apparatus, electrical and scientific instruments and parts, etc. Subscribers : H. G. Coe, 20, Russell Court, W.C.1 and P. Lyons, 90, Exeter House, Putney Heath, S.W.15.

Moran Bennett, Ltd. — Private company. Registered Aug. 19th. Capital, £100. Objects: To carry on the business of wireless, electrical, motor and general engineers, tool makers, lighting specialists, etc. E. N. Bennett, 11, Albert Road, Crumpsall, Manchester, is the first director. Registered office : Cromwell Buildings, Blackfriars Street, Manchester, 3.

Companies' Returns

Statements of Capital

Telephone & General Trust, Ltd.—Capital, £1,300,000 in £550,000 cumulative preference stock, £627,000 ordinary stock and 100,000 "A" ordinary and 23,000 ordinary shares of £1 each. Return dated May 4th. £550,000 preference stock, £627,000 ordinary stock and 100,000 "A" ordinary shares taken up. £1,200,517 6s. paid (including premiums). £160,000 considered as paid. Mortgages and charges : £800,000.

Lancashire Electric Light & Power Co., Ltd.—Capital, £4,571,415 in £571,415 6 per cent. (income tax free up to 6s. in the £) cumulative first preference stock, £1,000,000 7 per cent. cumulative participating preference stock, £2,900,000 ordinary stock and 100,000 unclassified shares of £1. Return dated March 5th (filed May 5th). All stock issued and fully paid up. Mortgages and charges £1,299,777.

North Lincolnshire & Howdenshire Electricity Co., Ltd.—Capital, £500,000 in £1 shares. Return dated May 4th. All shares taken up. £480,191 paid. £19,809 considered as paid. Mortgages and charges : Nil.

Trent Valley & High Peak Electricity Co. Ltd.—Capital, £200,000 in £1 shares. Return dated March 31st (filed May 7th). All shares taken up. £210,666 13s. 4d. paid (£1 per share, plus 2s. 8d. premium on 80,000 shares). Mortgages and charges : Nil.

Ringwood Electric Supply Co., Ltd.—Capital, £50,000 in £1 shares. Return dated March 31st (filed May 7th). All shares taken up. £50,000 paid. Mortgages and charges : Nil.

East Suffolk Electricity Distribution, Ltd.—Capital, £125,000 in ordinary shares of £1 each. Return dated March 31st (filed May 7th). All shares taken up. £125,000 paid, plus £10,000 premiums. Mortgages and charges : Not stated.

Concordia Electric Safety Lamp Co., Ltd.—Capital, £100,000 in £1 shares. Return dated April 13th. All shares taken up. £100,000 paid. Mortgages and charges : Nil.

John Richards & Co. (Electrical Engineers), Ltd.—Capital, £6,000 in £1 shares. Return dated December 31st, 1941 (filed May 13th). 4,802 shares taken up. £2 paid. £4,800 considered as paid. Mortgages and charges : Nil.

Mawdsley's, Ltd.—Capital, £75,000 in £1 shares. Return dated May 6th. All shares taken up. £69,000 paid. £6,000 considered as paid. Mortgages and charges : Nil.

Macintosh Cable Co., Ltd.—Capital, £250,000 in £1 shares. Return dated March 25th. 500 shares taken up. £500 paid. Mortgages and charges : Nil.

Seaford & Newhaven Electricity, Ltd.—Capital, £120,000 in ordinary shares of £1 each. Return dated May 12th. All shares taken up. £106,000 paid, being £1 per share on 92,000 and 10s. per share on 28,000 shares. Mortgages and charges : Nil.

Lancashire Dynamo & Crypto, Ltd.—Capital, £460,000 in 60,000 preference and 400,000 ordinary shares of £1. Return dated April 14th. All shares taken up. £422,508 paid. £37,492 considered as paid. Mortgages and charges : Nil.

F. D. Newcombe & Co., Ltd.—Capital, £30,000 in £1 shares. Return dated December 31st, 1941 (filed May 1st, 1942). 27,905 shares taken up. £22,905 paid. £5,000 considered as paid. Mortgages and charges : £4,000.

Mortgages and Charges

J. G. Smithson & Co., Ltd.—Satisfaction in full on July 30th, 1942, of mortgages, dated July 29th, August 15th, September 4th, 1940, May 1st, October 30th and December 18th, 1941, and January 14th and 17th, 1942, and registered August 5th, August 22nd, and September 9th, 1940, May 23rd, November 6th and December 29th, 1941, and January 27th (two), 1942, securing all moneys due or to become due from the company to Lloyds Bank, Ltd.

Lomax & Samways, Ltd.—Satisfaction in full on August 15th, 1942, of mortgage, dated January 22nd, 1940, and registered January 25th, 1940. (According to the register of mortgages the mortgages registered January 25th, 1940, originally secured £500.)

Presco Electrical, Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated July 28th, 1942, to secure £100. Holder : C. J. Revell, 3, Fulmer Corner, Tatling End, Gerrard's Cross, Bucks.

Dowsing Co. (Electrical Manufacturers), Ltd.—Issues between July 16th, 1937, and July 23rd, 1942, of £4,800 debentures, parts of a series already registered.

E. Dyne & Co., Ltd.—Mortgage on certain contract moneys, dated August 12th, 1942, to secure all moneys due or to become due from the company to Midland Bank, Ltd.

Companies to be Struck off Register

The names of the following companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary: British Belmont Radio, Ltd.; Gwalchmai Electricity Supply Co., Ltd.; Zendix Electric Co., Ltd. ; Johnson Electricals, Ltd.

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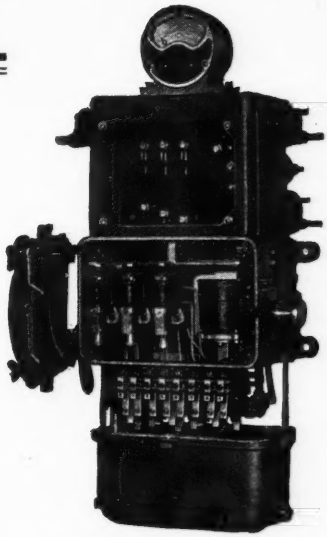

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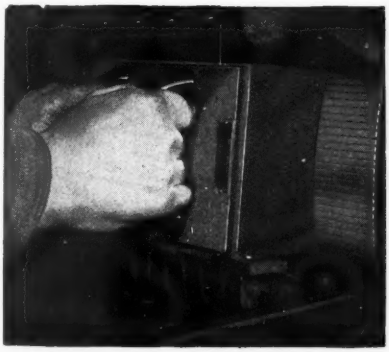

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STOCKS AND SHARES

TUESDAY EVENING.

STOCK EXCHANGE markets, standing on the very edge of war three years ago, were then in a more disturbed condition than they are to-day. Despite the gravity of the present Russian news, the depletion of our own industrial ranks, and the seriousness of the situation, Stock Exchange prices are firm, and business in securities goes on tranquilly. Investment readily absorbs stock that comes to market. Speculation, whatever the newspapers say to the contrary, buys and sells in markets where such transactions are easy enough to negotiate. Money is a drug in the market—to use the hackneyed phrase. The present week's price lists conform to the general practice of a few falls being well outnumbered by the rises.

Higher Prices

Directly any demand arises for particular shares, the scarcity of their supply becomes revealed, and the price has to be put up. A rise of 1s. 9d. to 60s. 6d. in Reyrolle shares makes a good illustration. The company is a first-rate concern and the shares at to-day's price yield no more than £4 2s. 0d. per cent. But buyers want them and are prepared to accept a gilt-edged yield in order to obtain sound security. Lancashire Dynamo ordinary hardened to 71s. 3d., Murex recovered to 97s. 6d., and Ericssons rose to 41s. 3d. For British Insulated there is persistent inquiry : the price is $\frac{1}{16}$ better at 95s. Shares in the "heavy" industries, *e.g.*, Babcock & Wilcox, Tube Investments, and Vickers, are attracting renewed support, as our price lists show. Hopkinsons are 1s. up at 51s., the yield tempting purchasers. Arons at 26s. have gained 1s. No falls have occurred in our list of equipment and manufacturing shares.

Ultra Electrics have moved up to 5s. The recent rise in E. K. Cole to 14s. has been maintained and the 7½ per cent. participating ordinary are $\frac{1}{16}$ higher at 23s. 9d. Engineering & Lighting Equipment 2s. ordinary shares at 2s. 6d. are ex the dividend of 1.44d. The 7 per cent. preference changed hands a few days ago at 21s. 6d.

Fuel Economy Campaign

Divergence of opinion is still expressed as to what is likely to be the outcome of the national fuel-saving campaign. The published diagrams, and the direct appeal to the householder to confine his consumption of fuel within strict limits, are in their way somewhat disturbing to holders of shares in electricity supply, gas and other illuminant companies. The passing of their interim dividends by the London Electric Supply and the South London Companies, as announced last week, has aroused a query as to whether some of the other companies may not reduce their dividends for the full year. In the Stock Exchange market, it is recognised that there are two distinct classes of electricity supply companies. One class caters more particularly for the domestic consumer; the other relies for most of its business upon the supplies to larger consumers. The latter are expected to feel little effect from the fuel economy campaign. With regard to the undertakings which cater especially for the residential user, a little hesitation is expressed as to whether these companies may not find their earnings fall away. London Electrics are $\frac{1}{16}$ down at 23s. 9d. Lancashires eased off to 33s., although the usual 3½ interim dividend was announced.

Front-Rank Industrials

It will be noticed that shares such as British Insulated, General Electric, Henley's, Callender's and others of this character give an average return upon the money of barely 4½ per cent. This seems, and is, a very modest return with which to be content from ordinary shares in any industrial company, however strong its finances and however well established its business. But the times are indeed out of joint; and to many people the great desideratum to-day is to invest money in securities upon which the present yield may be slender, but which have good prospects for after-war appreciation in price.

Taking the companies of the type just mentioned, it is clear that when matters resume a more normal course after the war, these undertakings will flourish like the proverbial bay tree.

Oriental Telephone

The price of Oriental Telephone shares is left unchanged at 55s., the meeting last week having no effect upon the quotation. The chairman entered at length into the extraordinary position in which the company now stands. Its Rangoon station has been demolished, its Hong Kong and Singapore properties are in the hands of the enemy. At the same time, the Oriental Telephone Co. stands possessed of a most unusual amount of cash and British Government securities: equal, it is computed, to 55s. to £3 per ordinary share. The interest which this sum is earning must necessarily, as the chairman pointed out, be modest. He hinted that the 10 per cent. dividend on the shares might be continued, though his statement on this head was none too positive. The anomaly is presented by the company possessing a huge amount of cash and gilt-edged securities, earning a meagre rate of interest, while, on the other hand, the value of the shares, a

(*Concluded on page* 317)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Sept. 1	Rise or Fall	Yield £ s. d.
Home Electricity Companies					
Bournemouth and Poole	12½	12½	50/-	..	5 0 0
British Power and Light	6	6	27/-	..	4 9 0
City of London	7	7	27/6	..	5 1 9
Clyde Valley	8	8	40/-	..	4 0 0
County of London	8	8	35/-	..	4 11 6
Edmundson's:					
7% Pref.	7	7	33/9	..	4 3 0
Ord.	6	6	28/-	..	4 5 9
Elec. Dis. Yorkshire	9	9	42/-	..	4 5 9
Elec. Fin. and Securities	12½	12½	48/9	..	5 2 6
Elec. Supply Corporation	10	10	45/-	..	4 9 0
Isle of Thanet	2	Nil	11/3	..	—
Lancs. Light and Power	7½	7½	33/-	−9d.	4 11 0
Llanelly Elec.	5½	5½	22/6	..	4 17 9
Lond. Assoc. Electric	4½	4	19/6	..	4 2 1
London Electric	6	6	22/9	−⅛	—
London Power Red. Deb.	5	5	105½	..	4 14 7
Metropolitan E.S.	8	8	35/-	..	4 11 6
Midland Counties	8	8	38/9	..	4 2 6
Mid. Elec. Power	9	9	42/-	..	4 5 9
Newcastle Elec.	7	7	28/9	..	4 17 5
North Eastern Elec. Ordinary	7	7	31/3	..	4 9 7
7% Pref.	7	7	33/6	..	4 3 7
Northampton	10	10	46/3	..	4 6 6
Notting Hill 6% Pref. (£10)	6	6	9	..	—
Northmet Power: Ordinary	7	7	32/6	..	4 6 2
6% Pref.	6	6	30/6	..	3 18 8
Richmond Elec.	6	6	25/-	..	—
Scottish Power	8	8	38/3	..	4 3 9
Southern Areas	5	5	20/-	..	5 0 0
South London	7	7	25/-	..	—
West Devon	5	5	22/6	..	4 9 0
West Glos.	4½	3½	20/-	..	3 10 0
Yorkshire Elec.	8	8	40/-	..	4 0 0
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	4/3	..	—
Calcutta Elec.	7*	7*	25/-	..	5 12 0
Cawnpore Elec.	10	10	25/-	..	8 0 0
East African Power	7	7	27/-	..	5 3 8
Jerusalem Elec.	7	5	17/6	..	5 14 4
Kalgoorlie (10/-)	7½	5	7/6	..	6 13 4
Madras Elec.	6*	4*	18/9	..	4 5 4
Montreal Power	1½	1½	24	..	6 5 0
Palestine Elec. "A"	Nil	4*	21/3	..	3 15 3
Perak Hydro-elec.	6	7	7/6	..	—
Shawinigan Power	83cts.	90cts.	15½	..	—
Tokyo Elec. 6%	6	6	13½	..	—
Victoria Falls Power	15	15	73/9	+⅛	4 1 4
Whitehall Inv. Pref.	5	5	15/9	..	6 7 0

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Sept. 1	Rise or Fall	Yield £ s. d.
Public Boards					
Central Electricity:					
1950–70	5	5	109	..	4 11 9
1955–75	5	5	115	..	4 7 0
1951–73	4½	4½	107½	..	4 3 7
1963–93	3½	3½	103½	..	3 7 8
1974–94	3½	3½	99½	..	3 5 4
London Elec. Trans. Ltd.	2½	2½	96	..	2 12 1
London & Home Counties 1955-75	4½	4½	109	..	4 2 7
Lond. Pass. Trans.:					
A	4½	4½	114½	..	3 18 7
B	5	5	114½	..	4 7 4
C	3	2½	47	+1	6 2 4
West Midlands J.E.A. 1948–68	5	5	110	..	4 11 0
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	110½	+½	5 8 7
Def.	1½	1½	26	..	5 15 5
Anglo-Portuguese	8	8	18/3	..	8 15 4
Cable & Wireless:					
5½ Pref.	5½	5½	103½	+½	5 6 3
Ord.	4	4	61	..	6 11 2
Canadian Marconi $1	Nil	4cts.	5/-	..	3 7 0
Globe Tel. & Tel.:					
Ord.	8½*	5*	27/6	..	3 12 9
Pref.	6	6	27/6	..	4 7 5
Great Northern Tel.: (£10)	Nil	Nil	16	+½	—
Inter. Tel. & Tel.	Nil	Nil	3	..	—
Marconi-Marine	7½	7½	30/-	+⅛	5 0 0
Oriental Tel. Ord.	16	10	55/-	..	3 12 9
Telephone Props.	6	Nil	11/3	..	—
Tele. Rentals (5/-)	10	10	9/3	+3d.	5 8 1
Traction and Transport					
Anglo Arg. Trans.:					
First Pref. (£5)	Nil	Nil	3/-	..	—
4% Inc.	Nil	Nil	8½	..	—
Brit. Elec. Traction:					
Def. Ord.	45	45	930	..	4 16 9
Pref. Ord.	8	8	170	..	4 14 2
Bristol Trams	8	10	45/-	−⅛	4 9 0
Brazil Traction	$1	50c	17½	+½	—
Calcutta Trams	8	5½	18/3	..	6 0 9
Cape Elec. Trams	5	5	20/6	+6d.	4 17 7
Lancs Transport	10	10	43/9	..	4 11 4
Mexican Light: 1st Bonds	5	5	90	..	5 11 1
Rio 5% Bonds	5	5	101	..	4 19 0
Southern Rly.:					
5% Prefd.	5	5	66	+1/-	7 11 6
5% Pref.	5	5	105½	..	4 14 9
T. Tilling	10	10	47/-	..	4 5 3
Tilling & B.A.	7*	6½*	5¢/3	+⅛	2 6 3
West Riding	10	10	38/6	..	5 4 0

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend 1939-40	Dividend 1940-41	Middle Price Sept. 1	Rise or Fall	Yield p.c. £ s. d.
Equipment and Manufacturing					
Aron Elec. Ord. ..	Nil	7½	26/–	+1–	5 15 5
Assoc. Elec. :					
Ord.	10	10	46/3	..	4 6 6
Pref.	8	8	39/6	..	4 1 0
Automatic Tel.&El.	12½	12½	52/6	..	4 15 3
Babcock & Wilcox	11	11	44/9	+⅛	4 18 3
British Aluminium	10	10	44/6	..	4 10 0
British Insul. Ord.	20	20	95/–	+⅛	4 4 3
British Thermostat (5/–)	18½	18½	16/3	..	5 13 10
British Vac. Cleaner (5/–)	12½	10	17/–	..	—
Brush Ord. (5/–) ..	Nil	6	6/6	..	4 12 4
Callender's ..	15	15	72/6	..	4 2 9
Chloride Elec. Storage	15	15	72/6	..	4 2 9
Cole, E. K. (5/–) ..	Nil	7	14/–	..	2 10 0
Consolidated Signal	17	17	70/–	..	4 17 2
Crabtree (10/–) ..	17½	17½	32/6	..	5 7 8
Crompton Parkinson Ord. (5/–) ..	30	20	21/3	..	4 14 0
E.M.I. (10/–) ..	Nil	6	17/–	..	3 10 10
Electric Construction	10	10	34/6	..	5 16 0
Enfield Cable Ord.	12½	12½	53/9	..	4 13 0
Elecl. Switchgear (10/–)	10	10	20/–	..	5 0 0
English Electric ..	10	10	41/3	..	4 17 0
Ensign Lamps (5/–)	25	25	16/3	..	7 13 10
Ericsson Tel. (5/–)	22*	20*	41/3	+⅛	2 8 6
Ever Ready (5/–)	40	40	32/6	..	6 3 0
Falk Stadelmann	7½	7½	23/9	..	6 6 4
Ferranti Pref. ..	7	7	27/6	..	5 1 10
G.F.O. :					
Pref.	6½	6½	33/9	..	3 17 0
Ord.	20	17½	80/–	..	4 7 6
Greenwood & Batley	15	15	30/–	..	10 0 0
Hall Telephone(10/–)	10	12½	20/–	..	6 5 0
Henley's (5/–) ..	20	20	22/6	..	4 9 1
4½% Pref. ..	4½	4½	22/6	..	4 0 0
Hopkinsons ..	15	15	51/–	+1/–	5 17 8
India Rubber Pref.	5½	5½	20/–	..	5 10 0
Intl. Combustion..	32½	30	107/6	..	5 12 0
Johnson & Phillips	15	15	60/–	..	5 0 0
Lancashire Dynamo	20	20	71/3	+⅛	5 12 4
Laurence, Scott(5/–)	15	12½	9/6	..	6 11 7
London Elec. Wire	7½	7½	28/3	..	5 6 2
Lucas, J.	15	15	66/3	..	4 10 8
Mather & Platt ..	10	10	40/–	..	5 0 0
Met. Elec. Cable Pref.	5½	5½	21/3	..	5 3 6
Murex	20	20	97/6	+⅛	4 2 0
Pye Deferred (5/–)	25	25	17/–	..	7 7 1
Revo (10/–) ..	20	17½	30/–	..	5 16 8
Reyrolle	12½	12½	60/6	+1/9	4 2 0
Siemens Ord. ..	7½	7½	26/3	..	5 14 3
Smith, S. (1/–) ..	50	37½	7/6	..	5 0 0
Strand Elec. (5/–)	2	4	4/6	..	4 9 0
Switchgear & Cowans (5/–) ..	15	10	10/–	..	5 0 0
T.C.C. (10/–) ..	5	5	15/–	..	3 6 8
T.C. & M... ..	10	10	43/9	..	4 11 4
Telephone Mfg.(5/–)	9	9	9/6	..	4 14 9
Thorn Elec. (5/–)..	20	20	15/–	..	6 13 4
Tube Investments	23½	20	85/6	+6d.	4 13 6
Vactric (5/–) ..	Nil	Nil	6/6	+6d.	—
Vickers (10/–) ..	10	10	17/–	..	5 17 3
Ward & Goldstone (5/–)	20	20	20/–	..	5 0 0
Westinghouse Brake	10	10	47/6	..	4 4 2
Walsall Conduits(4/–)	55	55	37/6	..	5 17 4
West, Allen (5/–)	7½	7½	5/9	..	6 10 5

* Dividends are paid free of Income Tax.

Stocks & Shares (*Continued from page* 315)

measured by the liquid assets, is very substantial. If, after the war, the company is able to establish that its properties were damaged or demolished at the instance of our own authorities, then, presumably, it will have the right to claim heavy compensation.

Miscellaneous Matters

Brazilian Tractions are an erratic market, the price moving fairly sharply. After a rise to 17⅞ it fell back to 16⅝; then rallied to 17¼, leaving half-a-dollar gain on the week. Mexican utilities are again in favour, speculation being fanned by publication of excellent traffic figures. The Indian group has moved softly. Amongst South African industrials Victoria Falls ordinary advanced to 73s. 9d. Cape Electric Trams hardened to 20s. 6d. Northern Telegraphs are 10s. up at 16. Tokyo Electric sixes have been changing hands at around 15½. Cable & Wireless ordinary retained, at 61, its two points rise of last week; the preference at 103½ is the fraction to the good. Marconi Marines at 30s. and Telephone Rentals at 9s. 3d. show modest improvements. A rise of $\frac{1}{16}$ in Tilling and B.A. ordinary shares took the price to 56s. 3d. The forthcoming division of the company into two separate entities is a matter of no great concern to the general public, there being but a limited market in the shares.

Preference Shares on Offer

At the present time there are 5,000 General Electric 7 per cent. "B" preference shares on offer in the Stock Exchange market at 37s., with dividends due at the end of June and December. At this price, the return on the money comes to £4 1s. 0d. per cent. The dividend service on these shares is covered, according to the last-issued report, more than fourteen times.

Another well-secured share is the 7 per cent. cumulative preference of the British Thomson-Houston Co. Of these shares, 2,000 are on offer at 34s., dividends also June and December. The yield is £4 2s. 3d. per cent. and the dividend margin is generous. Associated Electrical Industries 8 per cent. preference can be bought at 39s. to pay £4 2s. 0d.; the annual service of the shares requires £60,100, to cover which in the last-issued report there was £716,700.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specifications (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1940

10015. "Electric furnaces." Electric Furnace Co., Ltd., and R. H. Black. June 7th, 1940. (546861.)

10623. "Television receivers." Hazeltine Corporation. February 7th, 1940. (546932.)

15975. "Electric arc welding." W. L. Ulmer. November 1st, 1940. (546961.)

16123. "Gas-blast electric circuit-breakers." Akt.-Ges. Brown, Boveri & Cie. July 26th, 1939. (546992.)

17489. "Counting mechanism casing for measuring apparatus, such as electricity meters." Landis & Gyr Soc. Anon. December 12th, 1939. (546904.)

18224. "Electric induction motors." B. Schwarz. December 30th, 1940. (546862.)

1941

71. "Radio systems for landing aircraft." Standard Telephones & Cables, Ltd., and H. P. Williams. January 2nd, 1941. (546970.)

72. "Electric insulating material." Standard Telephones & Cables, Ltd., and A. A. New. January 2nd, 1941. (546971.)

1272. "Manufacture of powdered magnetic material." Marconi's Wireless Telegraph Co., Ltd. January 31st, 1940. (546863.)

1273. "Inductances." Marconi's Wireless Telegraph Co., Ltd. January 31st, 1940. (546864.)

1546. "Alternating-current rectification arrangements." Automatic Telephone & Electric Co., Ltd., and M. O. Williams. February 1941. (546976.)

1595. "Electrical relays." Westinghouse Brake & Signal Co., Ltd. September 7th, 1940. (546980.)

1612. "Electrical connections for shielded conductors." Bendix Aviation Corporation. January 22nd, 1940. (546982.)

1656. "Electric contacts." W. Aron and K. H. Hacklander. February 7th, 1941. (547006.)

1660. "Optical projection apparatus for checking the dimensions of articles." Hoover, Ltd., and A. H. Thomas. February 7th, 1941. (547007.)

1674. "Protective relays for train lighting and like installations" J. Stone & Co., Ltd., and L. R. Nixon. February 7th, 1941. (547008.)

1692. "Thermionic relay apparatus." Vacuum Science Products, Ltd., and H. S. Molyneux-Ffennell. February 7th, 1941. (547010.)

2653. "Welding." Linde Air Products Co. April 17th, 1940. (547012.)

4433. "Elastic-fluid turbines." British Thomson-Houston Co., Ltd. April 2nd, 1940. (546919.)

4639. "Condensers." Philips Lamps, Ltd. (Foote Mineral Co.). April 7th, 1941. (Convention date not granted.) (546940.)

4789. "Alkaline electric batteries or accumulators." Britannia Batteries, Ltd., R. M. Blomfield and F. G. Lomax. April 10th, 1941. (546941.)

5181. "Electric motor control systems." British Thomson-Houston Co., Ltd., H. W. C Liddiard and T. H. Petch, jun. April 22nd, 1941. (546942)

5298. "Portable hammer." Black & Decker Manufacturing Co. January 9th, 1941. (547017.)

5376. "Vent plug for an electric accumulator." Chloride Electrical Storage Co., Ltd., and H. Dean. April 25th, 1941. (546943.)

5448. "Windings for electric transformers." British Thomson-Houston Co., Ltd. April 26th, 1940. (547018.)

5606. "Electrical connectors." V. G. Manufacturing Co., Ltd., and J. H. Van Opstall. April 30th, 1941. (546920.)

5709. "Telephone systems." Siemens Bros. & Co., Ltd., E. W. Durkin and C. L. Peters. May 2nd, 1941. (546921.)

5790. "Electric transformers." C. Cutler. R. W. Flux and Metropolitan-Vickers Electrical Co., Ltd. May 3rd, 1941. (546946.)

5834. "Electric soldering irons." J. T. Sharples and Metropolitan-Vickers Electrical Co., Ltd. May 5th, 1941. (546947.)

8390. "Snap action electric switches." Dorman & Smith, Ltd., and F. E. Ryder. July 3rd, 1941. (546985.)

8452. "Means for regulating the temperature of a furnace or the like." Allmanna Svenska Elektriska Aktiebolaget. March 3rd, 1939. (Divided out of 538237.) (546925.)

8740. "Tool jigs." J. Collinson and Metropolitan-Vickers Electrical Co., Ltd. July 10th, 1941. (546926.)

10049. "Multiple colour television systems." Hazeltine Corporation. September 6th, 1940. (546987.)

10103. "Steam power plants." W. C. Fairweather (Svenska Turbinfabriks Aktiebolaget Ljungstrom). August 8th, 1941. (546988.)

10402. "Level regulating arrangements for electric signal transmission systems." Standard Telephones & Cables, Ltd. August 22nd, 1940. (546928.)

13609. "Electric insulating materials." Standard Telephones & Cables, Ltd., T. R. Scott and A. A. New. January 2nd, 1941. (Divided out of 546971.) (Cognate application, 13610/41.) (546990.)

1942

553. "Air-drying apparatus." British Thomson-Houston Co., Ltd. January 16th, 1941. (546888.)

1046. "Electro-magnetic relays." General Electric Co., Ltd., J. E. Collyer and N. C. Smart. January 26th, 1942. (546889.)

Amended Specification

528041. "Production of electro-magnetic oscillations." Board of Trustees of the Leland Stanford Junior University.

Train Lighting

Employment of Fluorescent Lamps

THE electric lighting of railway trains began on a large scale about thirty years ago, since when changes have been detailed rather than radical. But about seven years ago a considerable improvement of the interior illumination of railway coaches became possible in the United States because of the larger electricity generators that had to be incorporated in them for the purpose of air-conditioning the carriages. For example, the generator is now of 20 kW at 80 V (formerly 2 kW at 40 V) and the battery has been doubled, now consisting of 32 lead-acid, or 50 nickel-iron-alkaline, cells of 600 Ah capacity.

Consequential developments are reviewed (with circuit diagrams and bibliography) by Mr. W. S. H. Hamilton (New York Central Railroad) in *Electrical Engineering*, the official organ of the American Institute of Electrical Engineers. The author shows that modern lighting means from 7 to 15 ft.-candles at the 33 in. 45 deg. reading plane in coaches and a little more in other types of passenger carriages. Wattages are stated to be 11,400 for the air-conditioning compressor, 840 for the blower and exhaust fans, 1,350 for body lighting, 755 for other lamps and 555 lost in lamp regulators, making the total 14,900 W per coach. Thus even with the large-size batteries the effects of heavy lighting loads are becoming noticeable, indicating the desirability of a source of light that is more efficient than the incandescent lamp, with which the author deals before describing how power can be saved by the employment of hot-cathode fluorescent lamps.

Power Consumption Halved

With 15 W input to a white tubular lamp and about 5 W loss in its auxiliary devices, or a total input from the line of 20 W, some 4 per cent. more light is obtainable than from an incandescent 60-V lamp of 40 W. Therefore, exclusive of conversion losses, the power needed can be halved for approximately the same degree of illumination. In addition, the larger source distributes the light more evenly, while the effect of voltage variation is less noticeable, being from 1 to 2·5 per cent. against 3·5. Comfortable surface brightness determines the length and diameter of tubular lamps.

The disadvantages of fluorescent illumination are that the lamps will not continue to glow or re-ignite below certain voltages, the range on DC circuits being narrow (55 to 62 V for one size) and on AC circuits they are sensitive to frequency variation (58 to 62 cycles being the accepted standard range) most trouble having been associated with conversion devices, both motor-alternators and vibrator invertors being used. The latter are relatively more efficient (70 per cent.) quickly replaceable and fairly inexpensive, but subject to failure electrically and mechanically.

The desirability of eliminating conversion losses led to the development of DC fluorescent lamps capable of functioning at the voltage (down to 55 V) available on railway trains. With 60 V applied to the circuit a tube 15 inches long and 1.5 inches in diameter rated at 16 W, with 6 W expended in the ballast lamp and auxiliaries, provides an output of 560 lumens, which compares with 525 lumens from an AC tube and 504 lumens from a 40-W filament lamp. There is little encouragement to operate at 30 V, since the length of the tubes would have to be so reduced as to render them inefficient. Alternatively, inversion to AC would be necessary, or the provision of a booster to double the voltage, obtaining half the power from the battery. A recently developed voltage doubler of the vibrator type may be more efficient than a booster. Conventional operation with cold-cathode starting of the lamps is much simpler wherever AC at higher voltage is available.

The E.T.U. in 1941

Large Increase in Membership

WE have received from the Electrical Trades Union a copy of its annual report for the year ended December 31st, 1941. It is seen from this that there was a net increase of ten in the number of branches, raising the total to 398. The membership rose by 17,240 to 97,298, but the number of "exclusions" also increased—from 8,127 in 1940 to 8,134 last year. Over 10,000 members are with the Forces and 94 have been killed in action or have died on active service.

Special reference is made to the action taken during the year to ensure that Service members were being employed in positions suited to their skill. Evidence presented to the Beveridge Committee on the Use of Skilled Men in the Forces disclosed that over half of a selection of 265 members were not being used at all adequately according to their skill. Steps were then taken to remedy this position and the Union has continued to submit to the Committee particulars of members who were found to be in work not requiring the skill which they possessed.

The report says that much criticism has been directed against the Essential Work Orders, it being held that they operate with a certain amount of bias against the worker, while employers are allowed to contravene many provisions of the Orders. During the year there was a further extension of dilution, both of male and female labour, as a consequence of the further statutory regulation of labour.

Installation Section

It is stated that trade in the installation section of the industry remained exceptionally good, considerable difficulty in a number of cases having been experienced in meeting the demands of the employers. The arbitration upon the war adjustment of wages is recorded.

Other matters covered by the report, most of which have already received attention in our pages, are the Scottish war wages agreement negotiated with the E.C.A. of Scotland, electricity supply men's wages and the position of supply authorities' installation departments, railway electrical workers' wages, "dispersal bonuses," and wages in the shipbuilding industry.

The accounts show a total income for the year of £184,748, against £152,780 in 1940, and the amount in the general funds stood at £333,440 at the end of the year. After meeting all expenditure the balance on the year's working was £68,273.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—TOWNSVILLE (QUEENSLAND).—November 19th. City Council. Water-tube boiler of not less than 36,000 lb. per hr. evaporative capacity at a pressure of 200 lb. per sq. in. Specifications (£1 1s.) from A. Robertson, Town Clerk.

Northumberland.—Electric lighting and heating installations in public shelters at Ashington, and electric lighting at the Radcliffe School, Hauxley; county architect, Mitford Road Offices, Morpeth.

Orders Placed

Sheffield.—Electricity Committee. Accepted. Switchgear modification (£934).—A. Reyrolle & Co.

Health Committee. Accepted. Six "Ideal" electric refuse collecting vehicles (£2,100 each).—John Sherwood.

Stockport.—Town Council. Accepted. Two duplex horizontal pumps (£143).—Worthington-Simpson. Two centrifugal circulating pumps, electric motors and starters (£167).—Mather & Platt.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editor.

Batley.—Extensions to schools for nursery classes at Purlwell, Brownhill, and Carling How; borough surveyor, Brunswick Street.

Burnopfield (Co. Durham).—Canteen, Burnopfield colliery; L. J. Couves & Partners, 13, Westfield Terrace, Gosforth, Newcastle-on-Tyne.

Croydon.—Kitchen, Cypress School (£1,176); borough engineer.

Durham.—Mechanical laboratory at Jarrow Secondary School; county architect, 34, Old Elvet, Durham City.

Enfield.—Nursery and three fire stations; U.D.C. surveyor.

Glasgow.—Seamen's hostel, Nelson Street; Ministry of Works and Buildings.

Haslingden.—Three British Restaurants; R. Taylor, borough surveyor, Town Hall.

Hinckley.—New out-patients' department, male ward and nurses' home; superintendent, Hinckley and District General Hospital, Mount Road.

Manchester.—Works canteen; R. Carlyle & Co., Ltd., building contractors, Elsinore Road, Old Trafford, Manchester.

Market Harborough.—British Restaurant cooking depot and store, Kibworth; R. W. Turner, surveyor, Surveyor's Office, Kibworth, near Market Harborough.

North Riding.—Reconstruction of Canon A. R. Lee Senior School and the York Clifton (Without) Junior and Infants' School; county architect, County Hall, Northallerton.

Northumberland. — Decontamination laundry at St. George's Hospital, Morpeth; conversion of Newton Hall, Stocksfield, into an ante-natal hospital (central heating required); wartime nursery for Berwick and Tweedmouth; and a canteen at Belford School; county architect, Mitford Road Offices, Morpeth.

Oldham.—Canteen, cotton mill; Whitworth Whittaker, Ltd., Rochdale Road.

Portwood.—Workshop; John Needham & Sons, Ltd., Millgate Foundry, Stockport.

Salford.—Three British Restaurants; City Engineer's Department, Town Hall, Bexley Square, Salford, 3.

Tramway depot, offices, shelter, etc.; W. Gornall & Sons, Ltd., building contractors, Gore Street, Salford, 3.

Shipley.—Nurseries (£3,680); Michael Booth & Sons, Bradford.

Staffordshire.—Building for nursery, Pensnett (£2,325); C. M. Coombs, county architect, County Buildings, Stafford.

Stockport.—Rebuilding "Oddfellows Arms"; Architects' Department, Walker & Homfray, Ltd., Woodside Brewery, Stockport.

Stockton-on-Tees.—Converting premises in Imperial Avenue into flats; A. Harrison, builder, 69, High Street, Stockton.

Central kitchen at Ragworth Open-Air School for the E.C.; borough engineer.

Stretford.—Reinstatement of Trafford Park Laundry, and British Restaurant at Trafford Park; E. Parker, borough surveyor, Town Hall.

Sunderland.—British Restaurants at Hylton, Castletown and Silksworth (£1,770); R.D.C. surveyor, 1, The Esplanade, Sunderland.

Alterations in Tatham Street for the Missions to Seamen; J. Carter & Sons, builders, Deptford Terrace, Sunderland.

Canteen, rest room and shelter, Old Market; Matkin and Hawkins, architects, Fawcett Street, Sunderland.

Decontamination centres and control room for J. L. Thompson & Sons; G. T. Brown & Son, architects, 51, Fawcett Street, Sunderland.

Alterations for Hindells Dairy Co.; W. and T. R. Milburn, architects, 17, Fawcett Street, Sunderland.

Surrey.—Additional school canteens (£4,000); county architect, Kingston.

Tynemouth.—Additional accommodation for maternity cases at Preston Hospital; D. H. O'Herhily, borough engineer, North Shields.

Worcestershire.—Erection of nurses' home at Powick Mental Hospital, and adapting premises for day nurseries at Summerfield and Malvern; county architect, 38, Foregate Street, Worcester.

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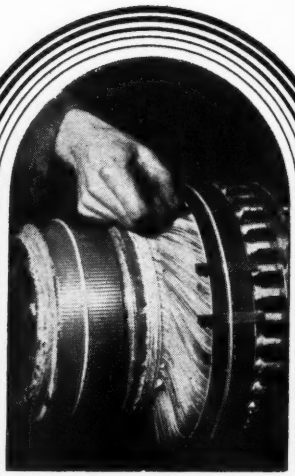

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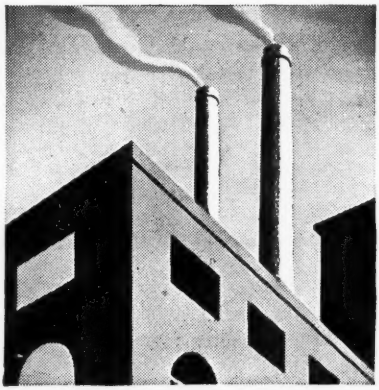

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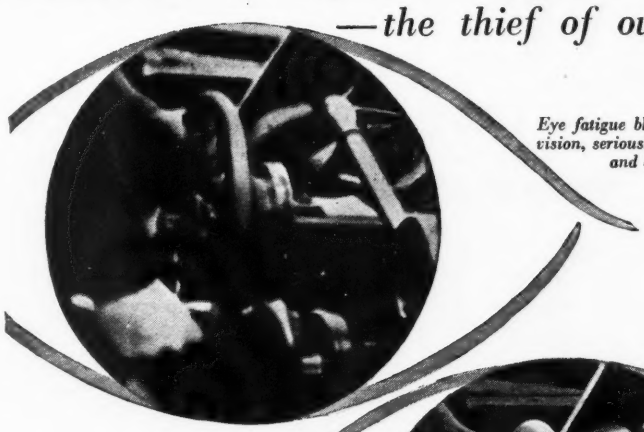
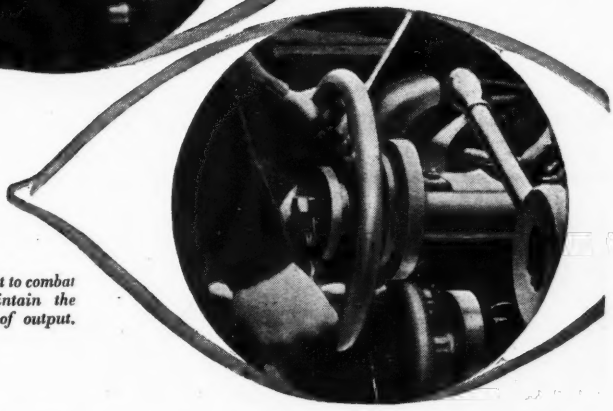
—*the thief of output*...



Eye fatigue blurs and slows the vision, seriously affecting output and accuracy.



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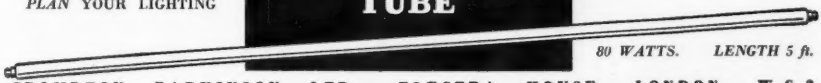

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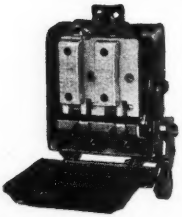

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2 Use of substitute solders with little or no tin. †

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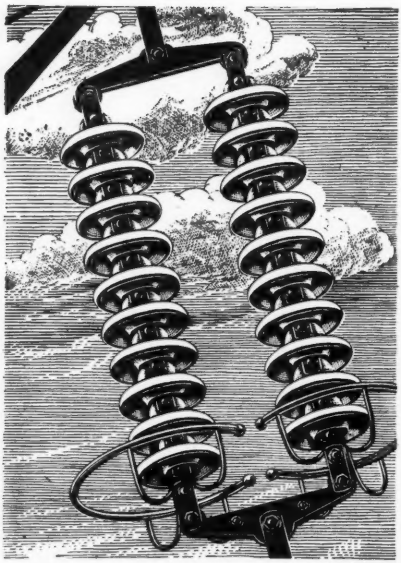

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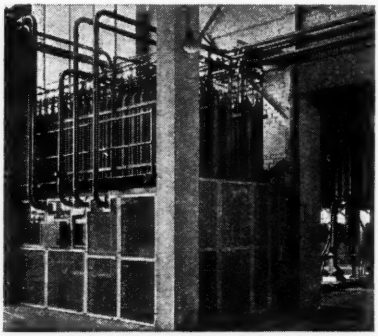

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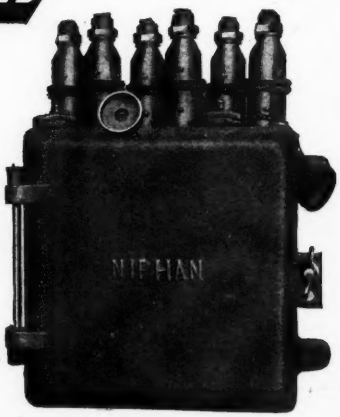

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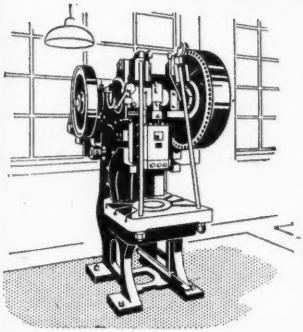

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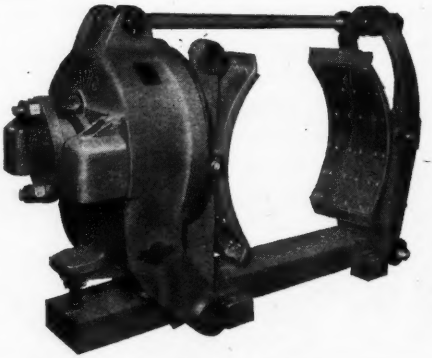

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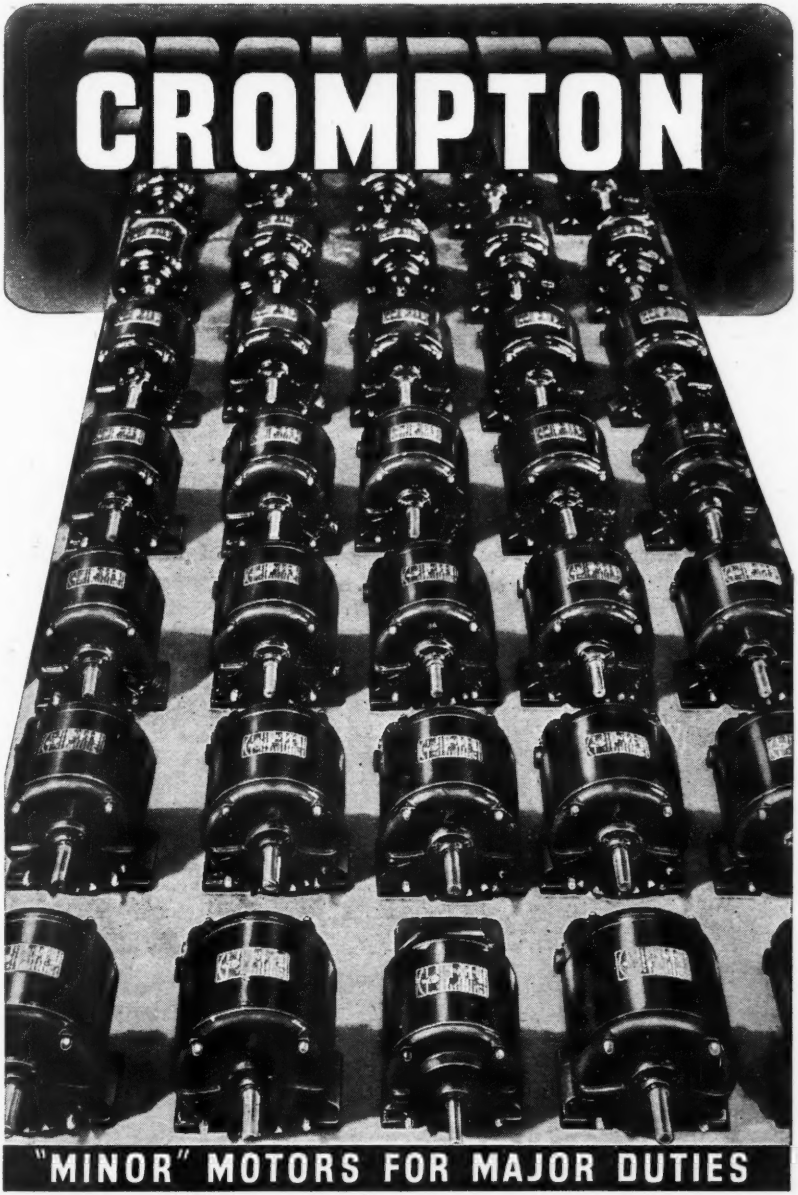

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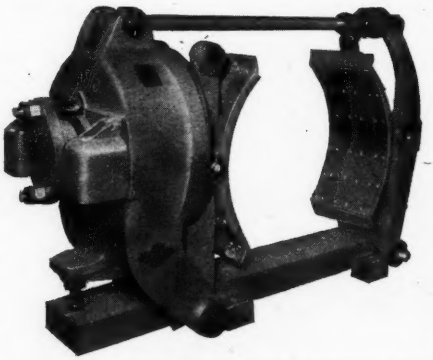

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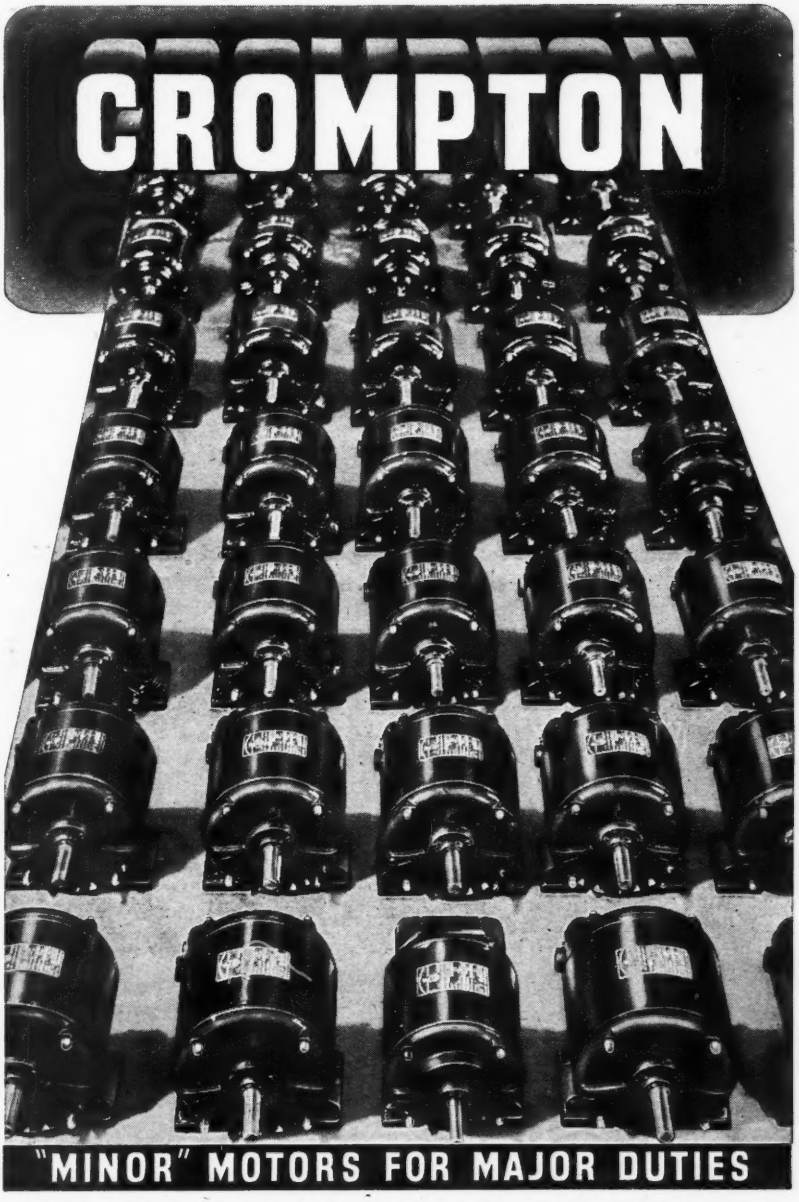

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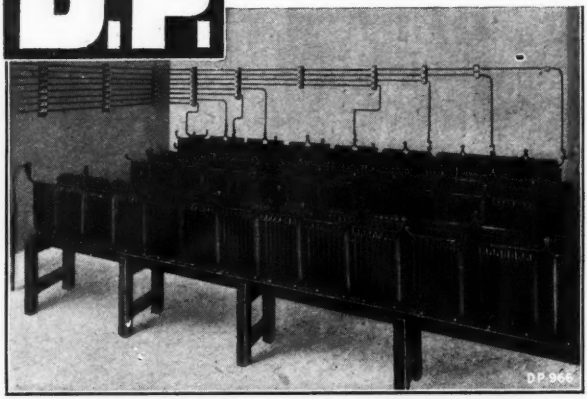

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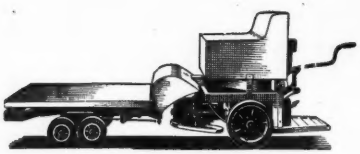

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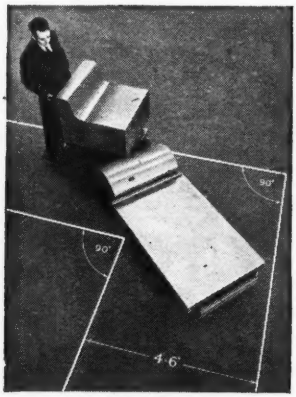

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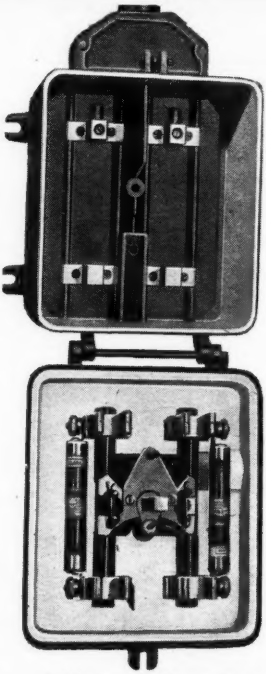

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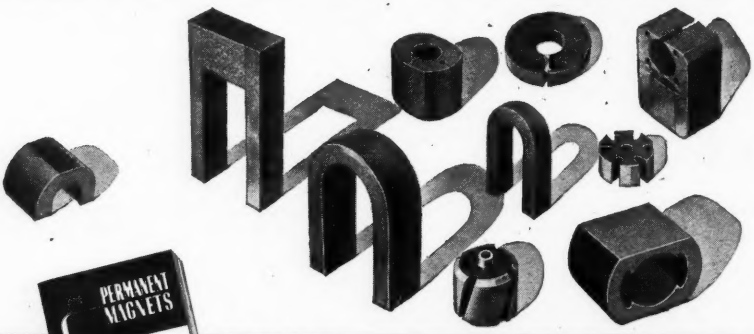

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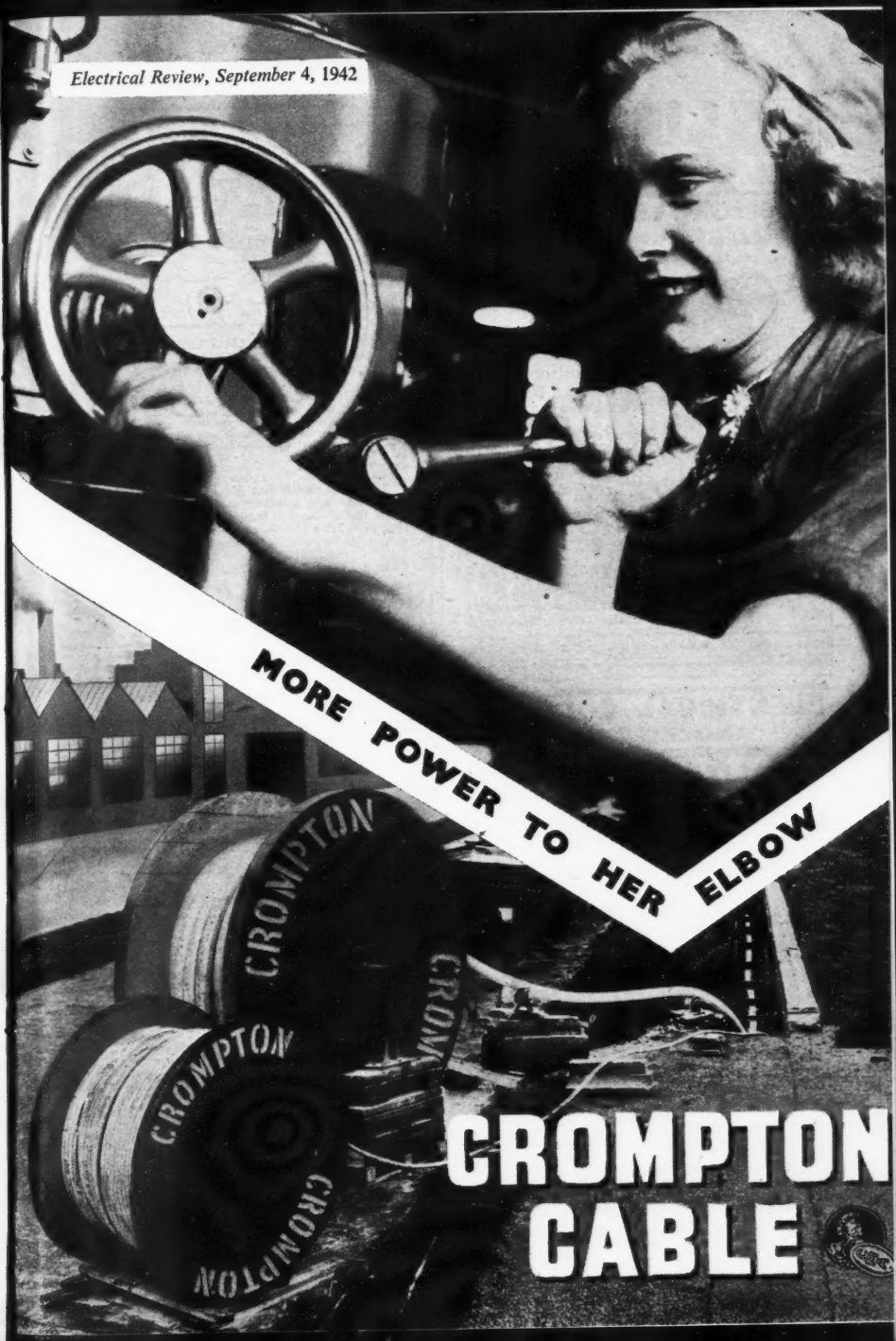

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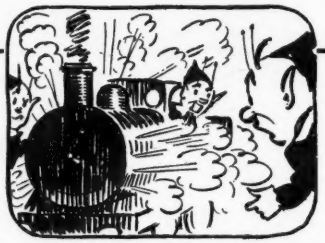

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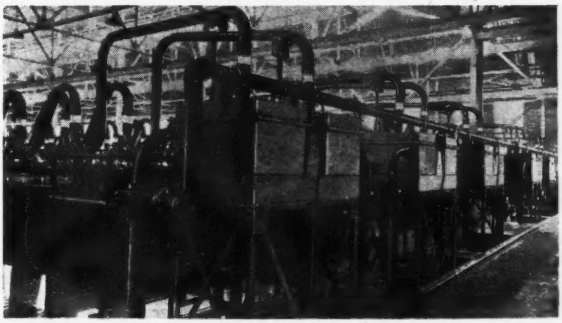

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